HEATING AND VENTILATING

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...ting Development ...ces . . page 51

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Table of Contents . . . page 3

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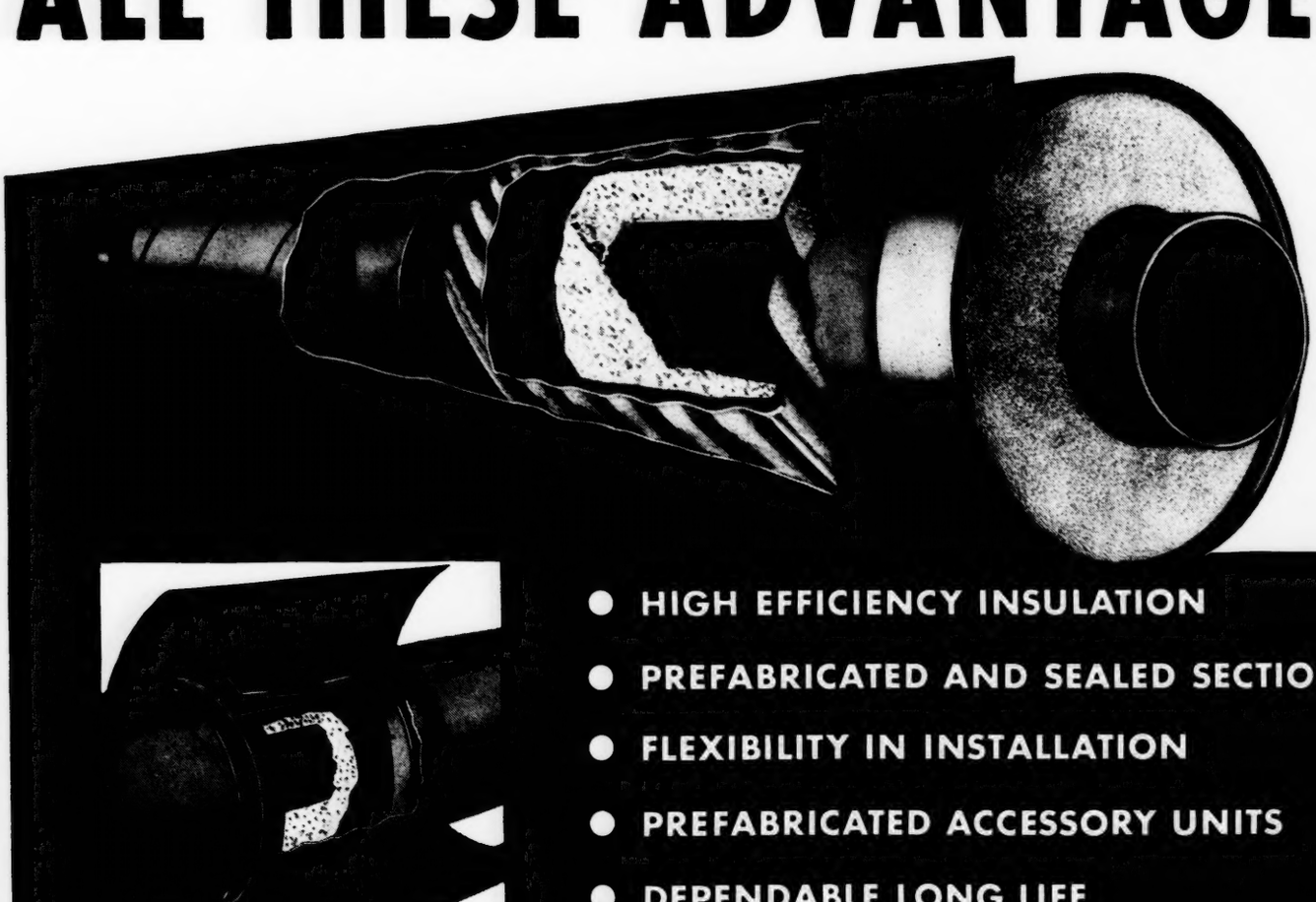

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CONTENTS FOR MARCH, 1950

VOLUME 47 NUMBER 3

ARTICLES

Designing the Heating System for the Development-Type House 51
I. G. Jalonack

Heating and Ventilating a Bus Garage and Repair Shop..... 54
J. K. Campbell

Pumps for Handling Fuel Oil..... 60
E. F. Opperman

Dry-Ice from Boilers..... 62

Air Conditioning in Production of Pharmaceutical Products.... 63
A. E. Tiesler

Design of a Radiant-Acoustic Ceiling..... 67
W. P. Chapman

Welding Stainless Steel Pipe..... 70
A. J. Ely, Jr.

The Role of Climatology in Air Conditioning Design..... 73
J. Everetts, Jr.

Heating a Locomotive Repair Shop..... 77

Sprayed Coating Seals Warehouses for Fumigation..... 78

Court Decisions of Interest to the Heating Industry..... 79

REFERENCE MATERIAL

Data Sheet—American Standard Graphical Symbols..... 82

DEPARTMENTS

Washington News—*Loring F. Overman*..... 47

Picture Paragraphs 82

Experience is my Classroom—*T. W. Reynolds*..... 83

News of Equipment and Materials..... 85

News of the Month..... 95

New Catalogs 98

Degree-Days for January, 1950..... 100

Abstracts and Reviews..... 104

Getting Personal 108

Since the Last Issue..... 108

Industrial Degree-Days for January, 1950..... 114

Canadian Degree-Days for January, 1950..... 116

Coming Events 116

The contents of HEATING AND VENTILATING are indexed monthly by Industrial Arts Index and by Engineering Index.

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THIS MONTH'S COVER

A cyclone dust col'ector is provided for each of the capsule-filling machines at the Pearl River, N. Y., plant of the Lederle Laboratories Division, American Cyanamid Co. Controlled air conditions are essential for satisfactory operation. See page 63.

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Write for Bulletin 34-C

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Washington News

LORING F. OVERMAN

WASHINGTON'S February was marked by a new appreciation of the shortness of the month and of the urgency of matters left incomplete in Congress as a result thereof. And as always, legislative schedules were forcibly altered by unanticipated developments requiring immediate attention.

Wishful thinking about cutting excise taxes speedily, while at the same time giving some thought to expense reductions which might help balance the budget, was rudely interrupted by two explosive situations, each having endless ramifications.

First there was the H-bomb controversy.

Next came the coal mine crisis.

At press time for this column neither had been settled, but each was sending up a smoke mushroom which may be expected to cast a shadow for years to come.

Whither Coal?

Some Washington observers were interpreting mine leader Lewis' cheeriness, in the face of costly injunctions, to an anticipation that Government would take over the mines. Legislation authorizing seizure was speedily introduced by pro-labor members of Congress, and press-time indications were that the increasing public clamor for somebody to do something might force favorable action.

Miners and their union have precedent for their willingness to bargain with Uncle Sam instead of with mine management. During another period of Government operation under wartime controls, the mine union was granted its first royalty contribution to a pension fund—a 5c a ton starter which has been since increased to 20c, and still remains "inadequate."

Nor is the Administration, apparently, averse to becoming the operator of the nation's coal producing facilities. Such a move, many believe, would be quite in line with policies which are unquestionably resulting in greater and greater concentration of power in Federal hands. Thus, with two parties to the controversy "willing and able" to make seizure a prelude to bargaining, such action appeared likely during the final February weekend.

That H-Bomb

Those who report from the Nation's Capital have little difficulty reading "something political" into every important Washington announcement. Release of the startling news about the H-bomb was no exception. In its timing might be seen the possibility that the public would require a powerful jolt before lending support to three measures receiving Congressional consideration—extension of the draft law, continuation of Marshall Plan appropriations, and proposals to increase military expenditures.

To these may be added the very real possibility that the announcement was timed to jar Moscow out of its atom-supported satisfaction over gains made through the medium of cold war. In any event the three proposals requiring Congressional approval and public acquiescence are all directed at a solution of the fourth possibility.

Important to H&V readers whose paths cross those of the Armed Services is the assumption, now current in Washington, that the United States is falling far behind in military preparedness. In numbers of planes, tanks, submarines, and men under arms, Washington is letting it be known that the country is a poor second. Without an exclusive on atom weapons, Washington is beginning to feel that its big words lack punch, and that there is only one answer—to provide the punch as quickly as possible.

Hence it may be anticipated that hopes of budget balancing will be countered with big talk about new and essential military needs; about the vital importance of continuing to shore up European economy; about the absorption of some 400 million Asiatics, and about the advisability of extending the draft law.

As always, the effectiveness of compromise has not been overlooked — particularly as it affects the sensibilities of voters in an election year. Thus, while the President has asked for a three-year extension of the present draft law, which expires June 24, there are indications that planners would be content with standby legislation. One such proposal calls merely for registration of eligible young men, to keep the records straight and to keep draft law machinery intact in case of future need. Another would close all but one draft office in each state and process registrations by mail—at a saving of $10 million a year, proponents claim.

One of the foregoing compromises, it is suspected, might relieve opposing pressure and smooth the way for acceptance of projects involving "only money." And such money! Guesses as to the cost of developing the hydrogen bomb range from $100 million to $4 billion. The President's budget for fiscal 1951 earmarks $817 million in cash and contract authority for the Atomic Energy Commission—including $144 million for production and development of "new and improved atomic weapons."

That such an expenditure would be only "a foot in the door" is indicated by the Washington-voiced suggestion that perhaps the B-36 bomber is not big enough to deliver the new bomb. This possibility, opening up a completely new concept of aviation, may be only the starting point in adjusting an entire military machine to new conditions.

Complete Overhaul?

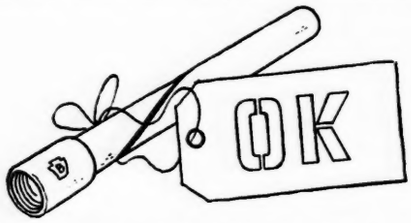
If it is to be assumed that much existing military materiel and production facilities must be modernized, a corollary is that a lot of additional money is going to have to come from somewhere. First upped request will come, it is likely, before the end of this session of Congress. Once Congress and the public are condi-

Here's a Good Tip for Everyone who wants to reduce Maintenance on Waste and Vent Lines

It's safe to say that *every* building with sanitary facilities has a corrosion problem . . . and that unless proper safeguards are used, you'll soon be paying for repairs, with replacement not far ahead.

Two of the worst trouble-makers are waste and vent lines. They are exposed to multiple attack from water . . . organic wastes . . . oxygen from the air . . . carbon dioxide . . . and sewer gases, which include ammonia and hydrogen sulfide. Any one of these is a dangerous enemy to pipe life. In combination, they represent a major hazard, and the only practical protection is through the use of a corrosion resistant material.

Wrought iron has been used in these severe services for long periods, and its superior durability



has been certified by service records of 50 years or more. In one study of a number of old buildings, wrought iron vents were still serving in one building after 49 years —in two after 48 years . . . and in three others after more than 45 years. In contrast, in a group of eleven buildings where low-first-cost materials had been used for vents, the life *to failure* averaged less than 23 years. In another study of a group of buildings over 20 years old, the engineer estimated the depreciation as 20% for the wrought iron vents, and 90% for the other material. Similar impressive performance figures support the choice of wrought iron for waste lines.

You'll find the reason for wrought iron's unusual durability in its unique composition and structure. Tiny fibers of glass-like silicate slag, threaded through the body of high-purity iron, halt and disperse corrosive attack, and so discourage pitting. Furthermore, the fibers help

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CORROSION COSTS YOU MORE THAN WROUGHT IRON

tioned to the idea, more will follow, and more. Ultimate effect, starting soon and continuing for "X" number of years, will be continued inflation, probably built upon deficit financing rather than upon marked tax increases, for the present.

Also likely is a new emphasis upon the strategic advantages of the Midwest and South for any new production facilities which may prove necessary. Military folks have not been at all hesitant in saying that this country's present concentration of heavy industry is not at all to their liking in planning A-H defense.

Thus the President's announcement of the H-bomb—startling enough of itself—may be the forerunner of industry and population migrations, architectural innovations, and probably structural experiments involving striking new applications of heating, ventilating and air-conditioning techniques.

Meanwhile, Housing Booms

Despite such gloomy implications, it would appear that not all branches of Government are convinced that the home of the future will be some sort of a hole in the ground.

Both the Senate and the House Banking Committees have approved for consideration by Congress the Administration's "middle-income" housing program for families in the $4,000 to $8,000 income bracket. The legislation, if finally passed, would set up new, special Government financial aid for cooperative housing projects and would extend present mortgage loan guarantee programs administered through the Federal Housing Administration.

The Senate bill, as approved by the committee, would form a new $1 billion quasi-governmental corporation to make long-term, low interest rate loans to housing cooperatives. The Administration sought $2 billion. The Senate group also cut to $1,750 million the Administration request for $2,750 million for additional home loan authority for existing programs. The latter portion of the bill would extend present Government programs for insuring loans made to repair or modernize homes, or to build new homes or rental property.

The House version would allot FHA the entire $2,750 million—$1,250 million at once, and the remaining $1,500 million subject to release by the President as needed. This proviso, as well as the Senate reductions, take into consideration the building industry's claim that the entire program is inflationary because it would impose huge new demands upon an industry which is already experiencing somewhat of a boom.

Basis for the industry's concern is the fact that January starts numbered 80,000, a record for the month, with potential demand indicating that 1950 will duplicate the 1949 record of more than a million housing units reaching the starting stage.

With FHA loan authority scheduled to expire March 1, it was anticipated that this phase of the program would be quickly approved. Fate of the new program for financing housing cooperatives was less certain. Bitter floor fights are anticipated in both houses. Adding strength for opponents' positions is the criticism from Chairman McCabe of the Federal Reserve Bank, who considers that the new financing feature would overtax facilities of the building industry and result in further price increases in the housing field.

FHA Authority Liberalized

Under the likely-to-be-passed FHA portion of the measure, the agency's authority to insure loans for modernizing and repair would be made permanent. Provisions for insuring rental housing mortgages would also be liberalized. Instead of permitting only 80% financing with a limit of $8,100 per family unit, the new measure as approved by the House committee would insure up to 90% of the first $7,000 per family unit and 60% of the value between $7,000 and $10,000 per family unit. Maximum mortgage would again be limited to $8,100 per family unit for projects averaging 4½ or more rooms per family unit. This provision is intended to encourage construction of rental properties with room for families with children. A separate provision in the bill provides that any company whose loan is Government guaranteed must promise not to discriminate against families with children on penalty of being held in default on the loan.

About Co-ops

The plan for aiding co-op housing projects would set up a new Government corporation to finance housing projects for "families of moderate incomes." The corporation could borrow $25 million from the Treasury to make loans to co-ops for planning the projects. The Treasury would be authorized to subscribe another $100 million for the corporation's capital stock to get the organization going. The corporation itself would raise the rest of its lending funds by selling up to its authorized capital limit ($2 billion in the House bill and $1 billion in the Senate version) to banks and other private investors.

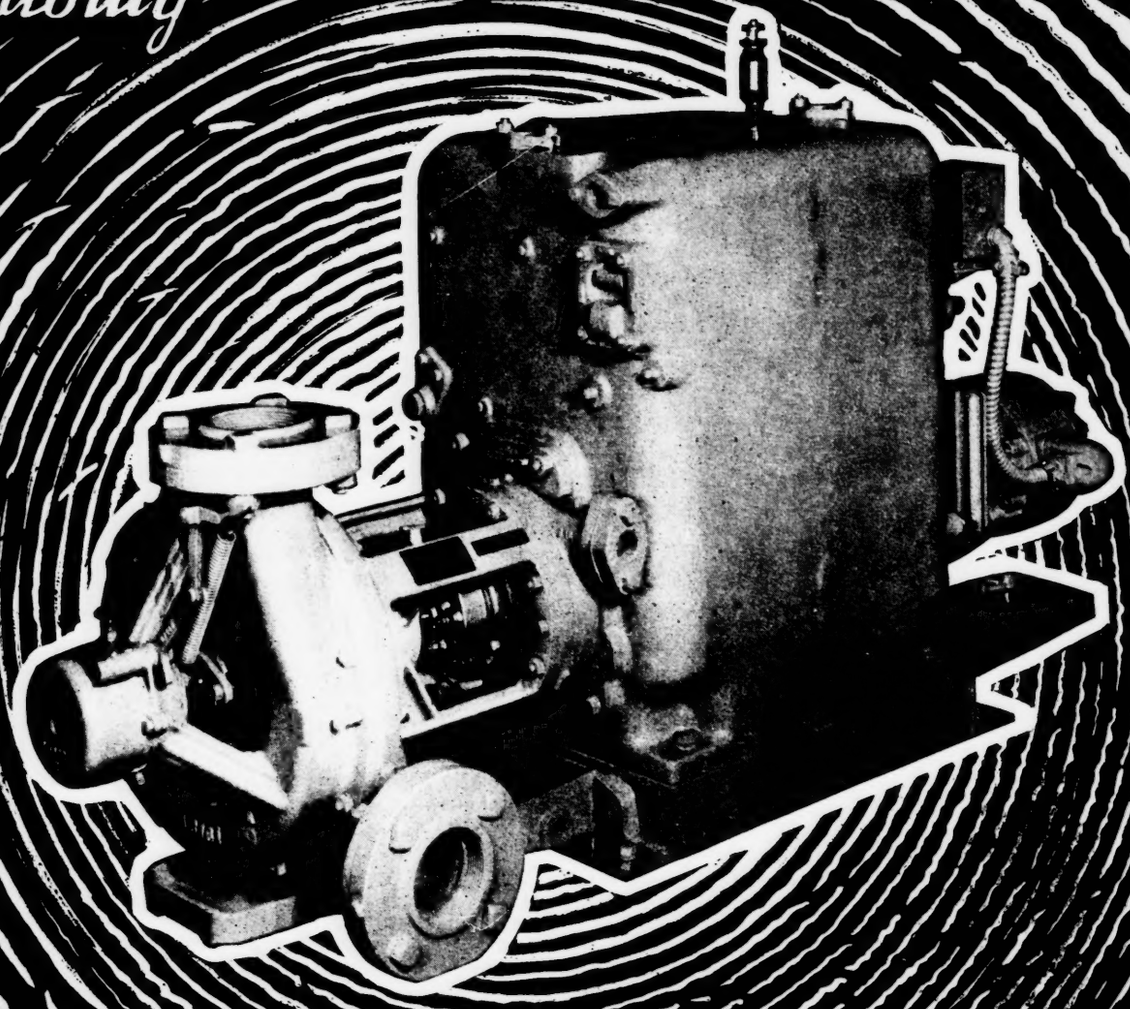
If the corporation approves a housing project proposed by a cooperative group, it could make a low-interest loan to the co-op for up to 63 years. The co-op, meanwhile, would subscribe to capital stock in the Government corporation in an amount equal to 10% of the mortgage loan, payable in installments covering five years. The Administration reasoning is that proceeds from the sale of stock to the co-ops will be used to finance new projects and will eventually retire the Treasury's share in the corporation.

School Construction?

A school construction bill as a possible substitute for several controversial measures having to do with Federal aid to education has been suggested by the House Committee on Education and Labor. Such a bill (H.R. 1551), calling for $300 million annually in RFC loans and grants to districts which apply for Federal aid in building schools, has been introduced by Rep. Lucas (D., Tex.).

Rep. McConnell (R., Pa.), ranking minority member of the committee, said he believed that a school construction bill, if it would not cost "billions of dollars," would unite more committee members than any proposal yet advanced.

Centralized Heating Economy



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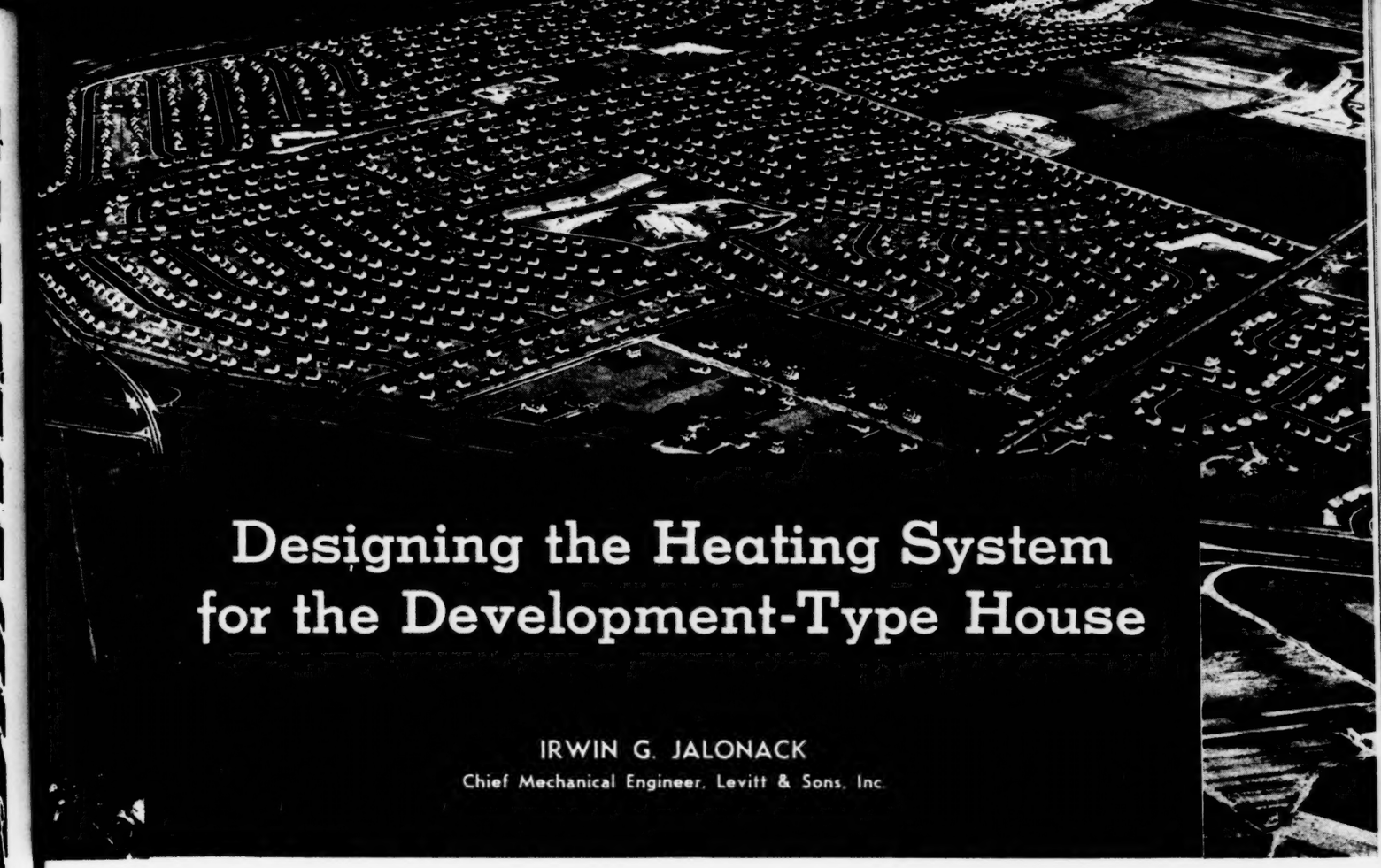

Designing the Heating System for the Development-Type House

IRWIN G. JALONACK
Chief Mechanical Engineer, Levitt & Sons, Inc.

Aerial view of a portion of Levittown, N. Y.

The one-family house, part of a large-scale housing development, benefits from a carefully designed heating system because of the importance of cutting building costs. In this article, the chief engineer for this country's largest housing development company – builder of Levittown, a community of 10,000 homes—discusses heating design and expresses some personal opinions based on his many years' experience in the housing field.

THE problem of heating design for a large-scale one-family detached housing development is especially unique. To begin with, it resembles the regular single-family house problem and is frequently attacked in the same manner. Due to the number of times the identical design is to be repeated, a more intensive engineering study is in order.

However, the design of the home heating system for the average single-family house is, in general, a field that is neglected by the consulting heating engineer. It is indeed rare that a house can afford such an engineering fee, and as a result the average home installation is designed by the heating contractor or a heating specialty manufacturer's agent. Most of these systems work satisfactorily, and if they do not it is usually a small task to rectify. As a rule, they are overdesigned, or computed with a large factor of safety. The overdesign results in at least design temperature in some rooms and higher temperatures in others, with the result that there is a waste of material, labor and money, which can only be condoned in a single house.

Now consider the plight of the large-scale housing designer. Any error which requires a service trip to correct has to be multiplied by the number of houses erected. This may be as great as 5,000. Since many heating faults show up only in cold weather when heat is required, possibly 3,000 untried systems may be actually installed before the first cold snap arrives. A design blunder in the heating system could cost, under these conditions, a half million dollars or more. It would seem obvious then that the thing to do would be to design ultra-safely and avoid this financial risk.

Unfortunately, the design problem is not quite so simple. A dual responsibility exists. Every $10 that is saved due to accurate heating designing means, on a 4,000 house development, a total of $40,000. While every $10 bill must be captured, not a dollar may be taken at the expense of the ultimate heating system satisfaction of the family who buys the house. On the other hand, it is most important for the builder to keep the house within the price range of the average wage earner.

As difficult as the problem may appear up to this point, it is child's play when compared with that resulting from limitations imposed by space. Since the present-day low-cost home cannot afford a cellar with its luxurious space for a heating plant, we must steal some space from within the house proper. Now it's the architect's toes that must be stepped on—and sensitive toes they are. He begrudges the heating designer any space at all and practically shrieks at the use of more than 4 sq ft of floor area. And do not slight this point. This 4 sq ft must be in a spot for which the house designer can find no half-way decent use. May the Lord help the heating designer if the proposed heater loca-

Unloading the copper tubing on the building location.

tion interferes with a hanging "whatnot" cabinet, or a flowerpot shelf! Still it is unfair not to recognize that the architect has problems of space and livability to comprehend within a fixed budget.

In the largest small-homes building project during 1949, a Levitt & Sons' job, the heating boiler and appurtenances are hung above the automatic washing machine. Therefore, it requires no floor area and precious little space.

Thus far the general problem, as presented, is to provide a heating system that will be:

(1) Adequate under all conditions.
(2) Economical in first cost and operation.
(3) Demanding of little or no space.

There are other important considerations beside these primary three, such as public acceptance of the type of heating system and operational noise.

Floor Coils

For a specific example, let us consider the heating in Levitt & Sons' 1949 section of Levittown. This job is the largest single dwelling development in the United States, and the relatively large number of houses emphasizes the points discussed.

In this development, copper tubing coils are embedded in the concrete floor of the house. Through these coils hot water is pumped when required. Thus we have a panel heating system. All of the so-called radiant systems using hot water as a medium are actually panel systems.

Tubing used in the floor is $\frac{3}{8}$ inch nominal type *L* placed on 12-inch centers. Since it now seems to be established beyond reasonable doubt that the bottleneck in heat transmission in such a system is the floor surface, the size of the tubing is determined basically by the hydraulics of the system. This fact seems to be overlooked in practically all discussions. The subject of hydraulics is usually brought in after the pipe sizes have been determined, and the question raised regarding the length of a given size circuit to be used in conjunction with a fixed pump capacity. The smallest size of tubing that is practical to use yields the most economical system. The only reason that $\frac{3}{8}$ inch nominal tubing is used in this job instead of a smaller tube is that too many circuits in parallel would have to be used. The use of too many circuits results in extra joints and each joint presents a potential leak hazard. There is also the factor of extra installation labor.

The conventional circulator as used on domestic water heating systems is one that is capable of pumping against a relatively low head. By that is meant that excessive resistance in the heating coils will sharply reduce the amount of water circulated. Since the amount of heat a system can give up depends on how much water is circulated as well as its temperature, the importance of proper and sufficient flow is apparent. Usually there are at least four zones with separate heating circuits in a small home. The division of the heating in this manner serves a double purpose for (1), it affords zone control of the sections served by the individual coils and (2), each coil carries only the water for its particular zone, say, $\frac{1}{4}$ of the total water. Therefore, the coil can be considerably smaller than if there were no zoning and all heating water had to pass through one long coil. In addition to the diminished amount of water for each coil offered by this zoning, it should also be clear that the length of the individual circuits is approximately $\frac{1}{4}$ of what they would otherwise be.

With other factors remaining the same, the head against which the circulator must pump depends on the length of the circuit, the amount of water in the circuit, and the size of the pipe. Before an efficient design can be made, one must understand the degree that each of these water flow factors affects the others.

A designer for a large-scale builder must not be taken in by things considered "gospel" in the trade.

For instance, shortly after the turn of the century, Prof. A. H. Barker made some observations on panel heating systems and expressed certain opinions on what might happen. Many of his expectations, he was free to admit, could only be proven from subsequent operations. Various authorities began to appear and expectations were treated as proven facts. An authority is anyone who will write an article. Each new authority repeated and restated as fact what had originally been practically a hypothesis. Thus, up until very recently, we had such myths as being comfortable with a 60F temperature, lower fuel costs, venting of all trapped lines regardless of water velocity through them, and pipe sized on the basis of how much wall area could be in contact with the concrete. So firmly embedded are some of the fallacies, that they still persist. From the background of over 10,000 successfully operating panel heating jobs, without a single bad one, facts to substantiate correct theory are available.

Forming the Coils

The design of the floor panel is discussed, not to present the necessary technical data, but to show the problem in relation to the heating picture for development housing. The method of prefabricating and installing the panel is possibly more interesting than the actual design, although actually not as important.

Copper tubing of sufficient length is wound around two properly spaced 12-inch diameter kegs, in the shape of a figure "8". When this is delivered to the proper location in the house, it can be spread out to form the room circuit. The diameter of the kegs determines the center-line distances of the tubing.

Thus, not only must the engineer for a project design carefully and economically, but the method of installation must also be worked out, and these two important phases coordinated. The designer, in this case, also must know thoroughly the mechanics of application.

Heating Boiler

The heating boiler, with its firing device, is apt to be the most expensive single item in the house. Therefore, it should pay the richest return if ingeniously designed. In this connection the story of the heating boiler of Levittown should prove of interest.

In 1947 some 3,000 homes were proposed to be built by Levitt & Sons, but no such number of heating boilers were available due to the lack of steel and the pent-up demand for boilers. The location offered for the heating plant was some 3½ sq ft in an alcove beneath the second-floor stairs. Gas was not available as a fuel, and, since oil was practically a must, it was decided that the domestic water should also be heated by the boiler. Lack of space precluded the use of a conventional hot water storage tank, and on Long Island anything less than a copper tank could expect a short life. The boiler selected was a rotary-fired copper coil boiler which was adequate for heating but carried insufficient rating for instantaneous water heating.

The solution turned out to be an especially designed 26-gal steel tank located above the heater. This tank, heated by 1½-inch gravity circulating lines from the heater, performed three basic functions. Immersed in its relatively large mass of hot water was an instantaneous copper water heating coil for domestic purposes. Thus the boiler could store up a large quantity of heated water over a period of time which made available, by transfer, the necessary heat for a heavy pull of domestic hot water. The top 4-gal space of the tank was left free of water so that it became the expansion tank for the system. An air eliminating valve was placed on this combination expansion tank, water heater, and heating water reservoir so that due to the tank's location, above the boiler, and the relatively low water velocity through it, the tank and the automatic air valve served to purge the heating system of air.

Thus the basic goals of the heating system were achieved in a year of extreme boiler shortage. It is worthy of note that the devices used had never before been used in that arrangement, and to that extent was experimental. The identical combination, as a prefabricated unit, is now available.

The year following this unique design, it became apparent that the system could be improved by combining the expansion tank in the boiler itself, thus saving money and the labor of piping in the combination tank. This design has proven so satisfactory that similarly it is now a standard unit and is available in the open market. In this case, the saving to the builder, due to the design, was about $40 per house. Multiply this figure by 4,000 and you have the reason for spending weeks, if necessary, on a single small design.

The heating boiler used this year by Levitt & Sons incorporates the same features of automatic air elimination and water heating as the previous year. It is suspended in space to avoid a demand on precious floor area. If someone with insufficient knowledge should attempt to copy this trick with an ordinary boiler-burner unit they could be in for a lot of grief. Aside from the structural knowledge required to adequately support the unit, there would be insufficient chimney draft for proper operation. Perhaps too late they would discover that the unit described has a forced draft fan which makes it independent of the natural chimney draft.

Contractors and house builders, without any basic knowledge or real conception of how the system works, are attempting to copy it. If an exact copy of all conditions were made, obviously the copy would work as well as the original. However, in duplicating, changes are often made. I have seen changes such as two heating coils installed in series instead of being placed in parallel; this would kill the heating in both circuits. I have seen circuits in parallel with large sized pipe and short runs, which results in haphazard heating.

The point that I am attempting to make is that it is not safe for any one, particularly a large builder, to partially copy a successful system, unless one has a thorough understanding of all of the involved principles and makes the necessary changes in design calculations. Unfortunately, due to the great deal of misinformation supplied by some alleged authorities who should know better, even a lot of heating engineers have been and are being misled. The only fortunate thing about the designs coming out of this misleading help is that, in general, the designs are supersafe. Such caution cannot be employed by a large-scale builder without sacrificing, due to this item alone, perhaps $200,000 in a development of 4,000 homes.

It is not my intent to convey the impression that the design of a heating system for the development-type of house is a tricky and complex thing. On the contrary, these homes have nearly the garden variety of hot water heating system. The guidance that is intended, however, is for those who may design a heating system for a large-scale development and for those who may be tempted to copy an existing successful design without a clear understanding of what makes the system function properly.

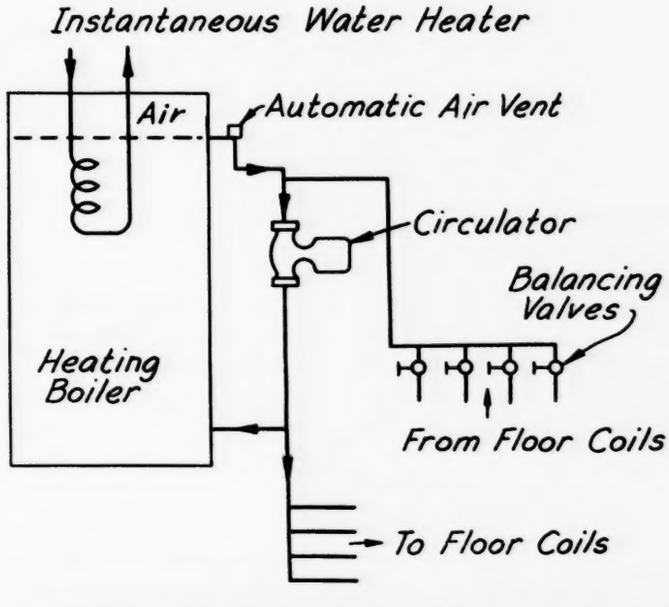

Diagram of the heating boiler and heating circuit.

Heating and Ventilating a

Bus Garage and Repair Shops

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A garage is being constructed in the Borough of Brooklyn, New York City, to provide garage space for 300 buses and shop facilities for 2,000 buses. To remove the toxic exhaust gases and fumes, special ventilating systems are provided. Both the ventilating and heating facilities of this $11,000,000 garage are described.

BUSES, which have replaced street cars in the Borough of Brooklyn, presented a serious problem to the Board of Transportation of the City of New York. Not only is it necessary to service, maintain and periodically overhaul these buses, but they have to be housed during the hours when they are not in use on the streets.

As a partial solution to this problem, the East New York Bus Garage and Shops are being constructed between Jamaica and Bushwick Avenues at Fanchon Place. The building has an overall length of 740 ft and a width of 322 ft.

The entire first floor, Fig. 1, with an area of over 4 acres and cubic content of over 3 million cubic feet, is used for garage space, for servicing, and for minor repairs. On the second floor, the same area is devoted to shops for complete overhauling and rebuilding operations on bodies, chassis and power units. A mezzanine extending over part of the second floor contains offices, class rooms, medical department, locker rooms and toilets. An L-shaped fan house, Fig. 2, is located on the roof.

Garage space on the first floor has the most exacting ventilating requirements. Owing to the grade of adjoining streets, the only doors are along Jamaica Ave. at the south end of the building; there are no openings for ventilation in the other walls of the garage area. Therefore, exhaust gas concentration in this area must be kept below the maximum safe limit entirely by mechanical ventilation.

Since this building must necessarily accommodate both gasoline and diesel-powered buses, the ventilating system must be capable of handling either type of bus, as well as varying proportions of each type. It was natural to consider first the requirements of gasoline buses, since these requirements have been subject to longer study and are more clearly defined than are the requirements of diesel buses. In this article first consideration will be the ventilation requirements for gasoline buses alone.

In the early twenties, vehicular tunnel ventilation was studied by the Bureau of Mines in preparation for the design of the Holland Tunnel ventilating system.

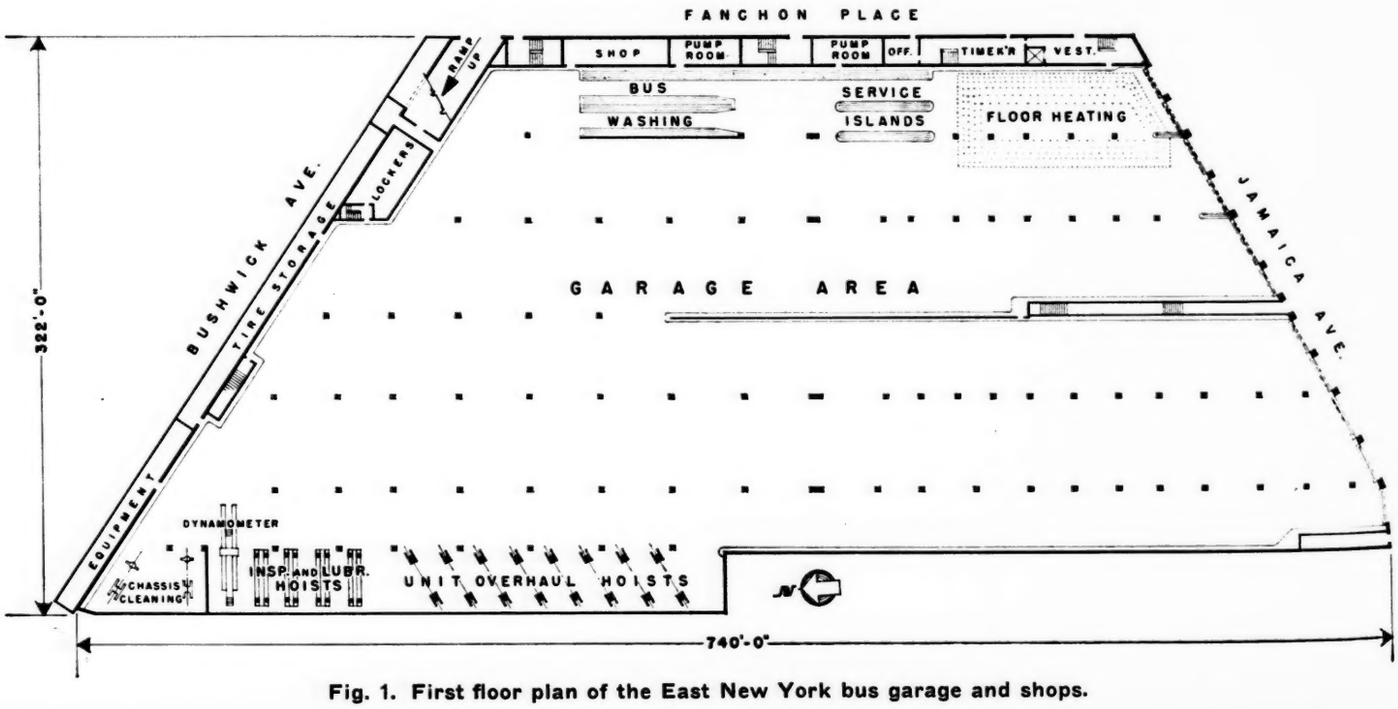

Fig. 1. First floor plan of the East New York bus garage and shops.

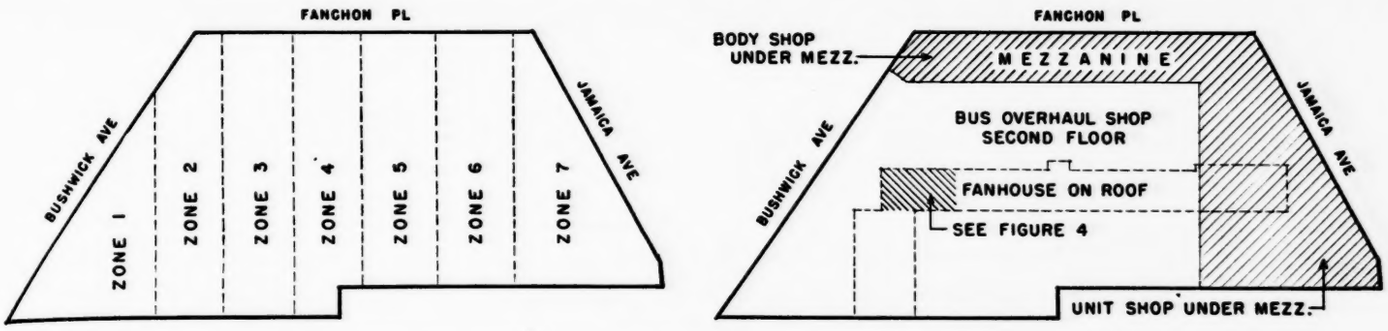

Fig. 2. Key plans showing (left) the ventilation zones for the first floor and (right) the layout for the upper floors of the garage.

While these studies were based on the action of only small passenger automobile engines, and on the comparatively small truck engines then in use, they did establish certain basic figures which apply to today's problems. These early studies indicated that approximately 80 cu ft of carbon monoxide are produced by the combustion of each gallon of gasoline.

Except for this basic figure, conditions in tunnels do not closely parallel conditions in this job. Therefore, before laying out this system, it was necessary to make observations on the actual bus models involved to determine how many gallons of gasoline they would each consume per hour when idling, when moving slowing around in the building, and when racing the engine. From these results was obtained an average gasoline consumption figure of 1.25 gph per bus engine in operation. On the basis of 80 cu ft of carbon monoxide per gallon of gasoline, each bus engine in operation in the garage produces an average of 100 cu ft of carbon monoxide per hour.

A large proportion of the buses begin their runs between 5 and 7 a.m. A careful study of the morning schedules indicated that an average of 60 bus engines are likely to be in operation at any time during this 2-hour period, including not only buses which are warming up preparatory to pulling out, but also buses which are returning from terminated runs, and those moving to inspection and repair areas.

Gas Dilution

Fig. 3 shows the average number of bus engines expected to be in operation during each hour of the day, the amount of CO liberated, and the quantity of fresh air required to dilute this CO to one part in 10,000.

During the morning peak load, the air change in the first floor garage area must be sufficiently rapid to prevent the concentration of exhaust fumes from rising above the permissible limit. While the generally recognized limit of CO concentration for persons exposed throughout a full 8-hour day is one part in 10,000, the fact that the expected number of pull-outs per hour from 5 to 7 a.m. outweighed those during other parts of the day by 4 or 5 to one, made it seem permissible to let the concentration during part of this 2-hour period run as high as 2 parts in 10,000. This dilution of 5,000:1, applied to the 100 cfm of CO produced by the maximum of 60 bus engines in operation, indicated a required peak load fresh air capacity of 500,000 cfm.

Fresh Air Demand

Since it appeared that approximately one-half this capacity would provide ample ventilation during all parts of the day except the 2-hour morning peak, the main ventilating system was provided with 7 supply fans with an aggregate capacity of 280,000 cfm and with a like number of exhaust fans of equal capacity. The floor area was divided into 7 zones of equal area, Fig. 2, with one supply fan and one exhaust fan to each zone. Since there is no physical separation between zones, certain of these fans may be shut down at periods of extremely light load.

To provide a total capacity of 500,000 cfm, two peak load fresh air fans with a total capacity of 220,000 cfm were arranged to discharge into the north end of the garage area. Since this peak load capacity will be required only during the morning period when the south doors are open, it was not considered necessary to provide exhaust fan capacity to balance this peak-load fresh air.

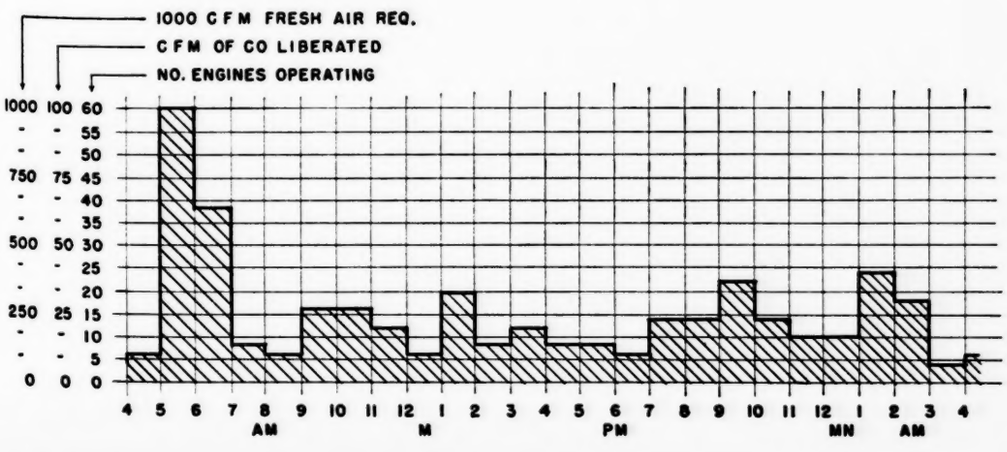

Fig. 3. Amount of fresh air required to keep the carbon monoxide content below one part in 10,000 parts.

All fresh air is drawn in through copper screens and louvers in the side walls of the fan house on the roof. This fan house is 600 ft long, about 50 ft wide, and with a clear height of 12 ft. Each fresh air inlet has an automatic self-cleaning, oil-impregnated type air filter. Fig. 4 and 5 show typical arrangements of supply and exhaust fans.

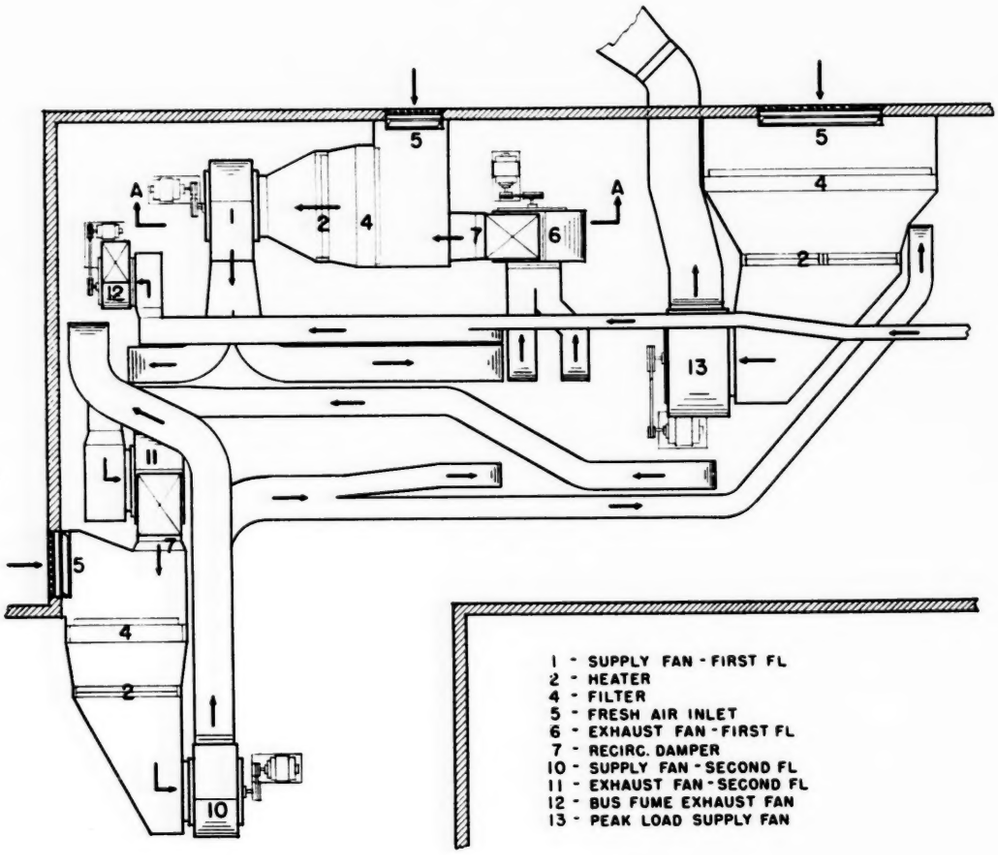
1 - SUPPLY FAN - FIRST FL
2 - HEATER
4 - FILTER
5 - FRESH AIR INLET
6 - EXHAUST FAN - FIRST FL
7 - RECIRC. DAMPER
10 - SUPPLY FAN - SECOND FL
11 - EXHAUST FAN - SECOND FL
12 - BUS FUME EXHAUST FAN
13 - PEAK LOAD SUPPLY FAN

Fig. 4. Plan showing the mechanical features installed in part of the fan house.

To prevent the drawing of foul air into the fresh air inlets, all exhaust fans discharge through outlets in the roof of the fan house. Each discharge outlet duct is protected against entrance of rain by a copper roof ventilator which is a modified model of the Pancoast type. Ventilators are designed to afford minimum resistance to air flow and to discharge a large proportion of the air vertically upward with considerable velocity. This is to avoid the possibility that horizontal wind currents across the roof of the fan house might carry foul air down into the eddy on the lee side of that house where it might be drawn into the fresh air inlet.

In general, fresh air is discharged through outlets near the floor of the garage area to break up any tendency toward stratification of heavy gases. In areas where there are no columns or walls down which supply ducts can be run, the ceiling supply outlets are arranged to discharge downward with full duct velocity. While the peak load fresh air fans discharge from horizontal outlets near the ceiling, the large volume of this fresh air, in itself, prevents the possibility of heavy gas lying on the floor, since it produces a general drift of 40 fpm air toward the doors. All of the general exhaust inlets are near the ceiling.

Heating

Adequate heating facilities are closely linked to the ventilation requirements and are of equal importance. If air temperatures in the garage area are allowed to fall much below 65F, the warm-up period of each bus before it is ready to pull out will be lengthened, thereby increasing exhaust gas pollution.

Most of the required heat is provided by preheaters in the fresh air intakes in the fan house. The fact that the garage area has practically no direct wall, window or roof exposure, and little, if any, natural air change or infiltration with the doors closed, practically eliminates the need for direct heating surface. Only at the large doors and in repair areas in the first floor are a limited number of unit heaters installed.

Where large quantities of fresh air are involved, the conservation of heat becomes important. Therefore, each exhaust fan is provided with a recirculating damper to close the outboard discharge opening and divert the air to the suction inlet of the adjacent fresh air fan serving the same zone. In each case, the recirculating damper is interlocked with the intake damper of the fresh air fan and the outlet damper of the exhaust fan. Recirculation can, of course, be used only when the concentration of exhaust gas is very low, and then only in a few zones at a time.

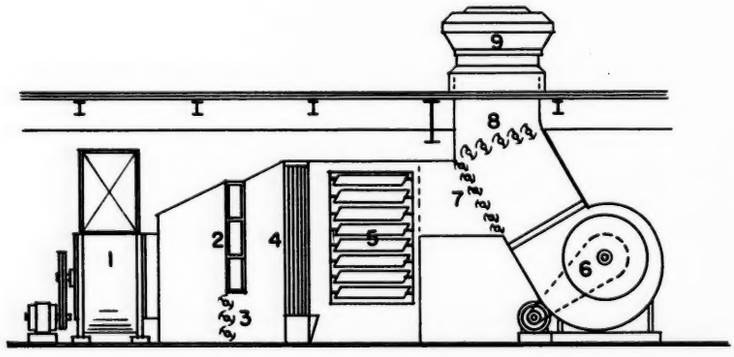

Fig. 5. Section through the fan house at A-A of Fig. 4.

A central control room was established to make practical the control of the many fans, heaters, recirculation dampers and other apparatus on which depends the effectiveness of the whole operation. In this room is a control board arranged to simulate the actual arrangement of the heating and ventilating apparatus on each floor of the building. On this board are control buttons and pilot lights for every fan motor, recirculating damper and preheater control valve. Pilot lights indicate the open or closed position of each of the 11 large doors serving the garage area. Remote reading thermometers are installed. The importance of this central control room in facilitating effective operation of the heating and ventilating system is readily appreciated when it is realized that the more distant of the 40-odd fans are 500 to 600 ft from the control room. For emergency use, local control is provided near each piece of apparatus. Fig. 6 shows the control board.

Fig. 6. Installing the control board for the heating and ventilating systems.

Air Sampling

To provide a convenient means of checking the degree of exhaust gas pollution in various parts of the area where buses may operate, air sampling tubes are run from sampling points, uniformly distributed throughout the area to be checked. These tubes all terminate in the control room where an exhauster may be provided to draw continuous samples. Throughout the garage area, 30 sampling points spaced on approximately 100 ft centers each way have been provided. Twelve additional sampling points are distributed throughout the bus overhaul shop on the second floor.

Diesel Engine Exhaust

While hazards of air pollution by exhaust gas from gasoline engines are now almost universally appreciated, the corresponding hazards due to diesel exhaust pollution are not so generally recognized. It has frequently been stated that a diesel engine produces no carbon monoxide. This is substantially true since a diesel engine in average adjustment may generate only 0.1 as much CO as a gasoline engine of the same power. The important fact regarding diesel exhaust, however, is that along with the small percentage of CO, the diesel gives off oxides of nitrogen, aldehydes and other compounds, some of which are considered to be 10 times as toxic as CO. Fortunately the smoke and foul odor which commonly accompany diesel exhaust give a warning of dangerous concentration, which warning may be lacking in the case of the more insidious gasoline engine exhaust.

Since an ever-increasing proportion of diesel buses will probably be accommodated in this bus garage, both gasoline and diesel exhaust gas pollution will prevail. In the early days of vehicular tunnels, a highly successful automatic CO detector was devised, which has been perfected to the point where it will give a continuous record of the percentage of CO pollution and will ring a bell if a predetermined percentage is exceeded. All the vehicular tunnel ventilating systems around New York City are operated in accordance with the readings observed on this type equipment.

However, up to now, no comparable device has been developed to deal with diesel exhaust pollution. Until such a device is available, it will be necessary to rely on odor and smoke as well as CO detectors as guides in operating the ventilating systems of bus garages such as this, to maintain safe conditions. Although the sampling tubes described have been installed, the installation of the exhauster and the automatic sampling and testing equipment has been deferred for now.

Diesel Operation Requirements

Recent studies by the Bureau of Mines, in connection with the operation of diesel mine locomotives in tunnels, indicate that the amount of fresh air which will sufficiently dilute the exhaust gases from a gasoline engine is ample to take care of the exhaust from a diesel engine of equal size.

On the basis of these studies, the recommended quantity of fresh air to be supplied for each diesel mine locomotive in operation is 75 cfm per horsepower developed at full speed and maximum load. A 160 hp locomotive would, therefore, require 12,000 cfm of fresh air when operating in normal mine service. It is obvious that a group of these locomotives or diesel buses of comparable power would require considerably less than that amount of ventilation when idling or moving slowly on a level surface without load, as in a garage.

While exhaust gas from buses which are free to move about the garage area is necessarily discharged into the air, special provisions have been made to prevent this in the case of buses which are undergoing repairs or testing. On the first floor, a system of underground cast iron bell and spigot pipe connects to a vertical duct leading up to a special bus fume exhaust fan in the fan house. Exhaust inlets, connected to this piping, have been located in the floor near each hydraulic hoist, dynamometer, or other simliar fixed working station, and flexible connections

provided to attach these inlets to the bus tail-pipes.

In the garage area, gasoline fumes as well as exhaust gases constitute an important hazard. All buses entering the garage area use the 3 right-hand lanes which lead past the service islands where fuel tanks are refilled and oil levels in crankcases are checked. In the steel curb around each service island, a continuous slot communicates with the space under the island. The spaces are provided with drains and are connected to an underground exhaust duct leading to a pair of exhaust fans. Any gasoline which is spilled will drain through the slot, while the heavy vapor which hugs the ground will also be drawn into the slot and be disposed of by the exhaust fans so arranged that one is normally in operation. The other fan is so connected, electrically and by dampers, that it will automatically come up to speed and take over the load if the first fan becomes inoperative.

A similar exhaust ventilating system is provided to serve the 4 underground fuel tank vaults, each vault containing two 5,000-gallon gasoline tanks, installed in accordance with the requirements of the Board of Standards and Appeals of the City of New York.

Exhaust ventilating connections are also run from the general exhaust system to all elevator pits in the building to prevent the accumulation of gasoline vapor in these low spots.

Snow Melting

During the winter the entrance aisles which lead to the service islands receive heavy deposits of snow and ice dropped from underbodies and wheels. To promote rapid melting of these deposits, a system of hot water panel heating was provided for this service aisle area. In the entrances of other bus garages, where no provisions have been made for snow melting, the slush becomes mixed with congealed grease to result in a highly slippery condition. It is not planned to operate the panel heating system when snow and ice are not present.

Light Repairs

A rear corner of the first floor is for inspection and light repairs. Four hydraulic hoists are provided for buses which are to be subjected to daily pull-in inspection, 1,500-mile inspection and 6,000-mile inspection, as well as for chassis lubrication and oil change. Here, also, tires are serviced and minor repairs made.

Of the 10 remaining hydraulic hoists in this location, 2 hoists are fitted for chassis cleaning and 8 hoists for light engine overhaul jobs. For the chassis-cleaning operation, the buses are lifted so that steam nozzles or high pressure water jets may be used to dislodge the accumulation of mud and grease. Exhaust ducts serving this area are constructed entirely of copper, since steel ducts would be rapidly corroded by the steam and spray generated by the cleaning process.

As on the first floor, the general fresh air supply ducts in the second floor bus overhaul shop are carried down columns or walls to discharge near the floor to break up any stratification either of exhaust fumes or of cold air in winter. Where the supply registers are adjacent to any of the hydraulic hoists, diffusers are provided to prevent objectionable drafts which would inconvenience men working nearby. Similar to the first floor, general exhaust registers are near the ceiling.

At each of the 57 hydraulic hoists in the second floor bus overhaul shop there is provided a tail-pipe exhaust inlet similar to those on the first floor. The engine exhaust ducts serving these second floor inlets run on the ceiling of the first floor and connect to separate bus fume exhaust fans in the fan house.

Cleaning Operations

A special exhaust system serves the battery room on the second floor where the storage batteries used in the buses are repaired and recharged. Another special exhaust system serves the single chassis cleaning booth on the second floor.

These exhaust systems serving engine exhaust inlets, service islands, chassis cleaning and battery room all handle air which is too heavily polluted to make its recirculation desirable at any time. The same thing is true of the exhaust system drawing from the welding room, radiator and gas tank repair room and the bearing cleaning room—rooms which contain undesirable fumes or vapors.

Engines, transmissions and rear ends are completely disassembled and cleaned in the cleaning and stripping room. An additional problem results due to the heated cleaning tanks giving off a considerable volume of steam. The whole area around these tanks is covered with an exhaust hood that forms a saw-tooth ceiling of transite panels set at 45 deg to prevent dripping. Parallel slots between upper edges of panels assure a uniform distribution of the exhaust. Moisture, which condenses and runs to the bottom of the sloping panels, is caught and carried off in brass channel gutters. Copper exhaust ducts draw from the space above the sloping panels and lead to the exhaust fan in the fan house.

The body shop on the second floor has two paint spray booths of the water-wash type, one 8 ft wide and one 4 ft wide. Each is provided with a settling tank, a circulating pump, and a set of spray nozzles and spray eliminating baffles. This type spray booth not only minimizes clogged fan blades and the danger of fire in exhaust ducts, but it also tends to prevent damage to surrounding property from wind-borne paint particles, some of which remain sticky for several hours after being discharged into the air.

Operations carried on in the bearing room and in the torque converter room are of such an exacting nature that additional filters and booster fans are provided on the fresh air supply ducts for added air filtering to each of these rooms. Not a particle of gritty dust can, therefore, come in contact with the ball or roller bearings or enter any of the intricate and closely fitted mechanisms of the torque converters which form a part of automatic bus transmission.

The diesel test room, where diesel nozzles and high pressure injection pumps are assembled and tested, not only requires a fresh air filter and booster supply

fan, but also a special oil-arresting filter on the exhaust duct serving this room. Without such a filter the vapor formed of oil droplets would coat the inside of the exhaust ducts and constitute a serious fire hazard.

Approximately once a year, or after 40,000 to 50,000 miles, each bus gets a light engine overhaul involving new valves and rings and possibly some bearings. Most of these minor overhauls are performed on the first floor. After approximately 100,000 miles service, engines get a complete rebuilding.

Engine Tests

After assembly and preliminary testing, each engine is given at least an 8-hour run at various loads on an engine dynamometer in the engine test room. Requirements for this room are that it have a rapid air change and that the walls be reasonably sound proof. The electric output of the electric generator type dynamometers is dissipated as heat from resistance grids located outside of this room.

The special exhaust systems which serve to remove dust, gases or fumes from the second floor are usually in operation throughout the working day. They remove about 70,000 cfm of foul air from that area. That the general supply and exhaust system may maintain a plenum condition to minimize infiltration and the entrance of dust, the general exhaust fans serving the second floor are provided with 2-speed motors so that they may operate at reduced speed when the various special exhaust systems are in operation.

When recirculation is desired under these conditions of reduced exhaust fan output, a special damper control is used which closes the outlet damper from the exhaust fan, but opens both the recirculation damper and the fresh air inlet damper.

Other Operations

Some of the dust-producing operations in the body shop or the unit shop can be handled better by individual self-contained systems than by a large central system. As an example, woodworking machines in the body shop, which are used only intermittently, are provided with a system for collecting and disposing of sawdust and shavings. It consists of a compact assembly of electric motor-driven exhauster, with centrifugal separator and air filter. Galvanized sheet iron suction ducts are connected to each of the woodworking machines. Air leaving the filter is sufficiently dust-free to permit its recirculation to the room.

Other operations in the body shop for which self-contained dust removal equipment has been provided are glass grinding, sand blasting and grinding-wheels for production work. In the unit shop, similar provisions are provided for brake-drum grinding, and wire brushing and sand blasting of parts reclaimed in the stripping room.

While operations of the first floor garage area will be continuous around the clock, seven days a week, the work on the second floor and mezzanine is likely to be limited to one, or at most, two shifts per day. To take care of transmission and infiltration losses while the ventilating systems of these floors are shut down at night and on week-ends, direct radiation and, in some locations, unit heaters have been provided, designed to heat to 55F in zero weather.

All indirect heaters on fresh air intakes are controlled by duct thermostats, but each heater is also controlled by a switch on the central control board by which the operator can cut the steam off when heat is not required.

The fan room penthouse will be heated by the uncovered heater casings and tempered air ducts, the temperature of which will never be much above 70F. While this heat will be continuously available during all normal occupancy of the building, unit heaters have been provided to keep this area above 50F under any conditions.

Ventilating ducts that pass through floors or fire walls have approved automatic fire dampers. In every case, access doors have been placed to facilitate checking the position of the damper and inspecting the fusible link mechanism.

The East New York Bus Garage and Shops were planned by the engineering staff of the Board of Transportation of the City of New York, under the direction of James H. Griffin, Chief Engineer, and the various Division Engineers concerned. Eadie, Freund & Campbell served as consultants on heating and ventilation. Almirall & Co., Inc. was the heating and ventilating contractor.

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Pumps for Handling Fuel Oil

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A discussion of the various pumps available for handling fuel oil to or from storage tanks, and to oil burners, and the type pump most suitable for specific operating conditions.

THE ease with which fuel oil can be handled mechanically makes it easy to transfer the oil from one vehicle to another, regardless of shape. It can be stored underground or in any suitable location, thereby releasing valuable space within the building. Fuel oil is handled mechanically by pumps in conjunction with piping systems that include fittings, valves, strainers, pressure regulators, metering and measuring devices.

There are predominantly two types of pumps for pumping fuel oil; namely, reciprocating pumps, and gear pumps. Although reciprocating pumps were employed by the petroleum industry in the past, at the present time they have largely been replaced by gear pumps. The reciprocating pump is now used only where high pressure steam is available and where high oil pressures are desired.

Centrifugal pumps are widely used for moving water and other non-viscous liquids. They are seldom used, if at all, in the petroleum industry. The high speed at which centrifugal pumps must be operated makes them very impractical for use with viscous fluids.

Internal Gear Pump

The gear pump is classified into two divisions—the external gear, Fig. 1, and the internal gear types, Fig. 2. Of the two types the internal gear pump provides the best operating performance. The principal components of the internal gear pump are a pump housing with inlet and outlet tappings, rotor or outer gear, an idler or inner gear, a single shaft, a crescent to separate the inlet part from the outlet, a headplate or cover, and a seal or packing gland. The inner gear is located inside and its teeth mesh with the inside teeth of the outer gear. The outer gear is attached to the propelling shaft which in turn rotates both gears. Rotation can be in either direction provided the suction and discharge piping are arranged accordingly. When the pump is first started, it is necessary to seal the running clearance of the gears with oil. As the gears rotate, air from the inlet port is trapped between the crescent and the spaces between the teeth of the gears. The air is expelled into the discharge port and thus into the discharge piping.

The inlet port is separated from the outlet port by the crescent and by the meshing of the gears before and beyond the crescent. Thus, a suction is established that first expels the air from the suction line, followed by the oil that is forced into the partially evacuated pipe by the action of the atmospheric pressure on the liquid surface in the storage tank.

Pump gears and shaft are made of steel and are finished to very close tolerances. The housing and headplate cover are made from castings machined to the same accuracy. The headplate is secured to the housing with cap-screws. While a head gasket generally separates the two surfaces, on some pumps this gasket is not required. Where the shaft enters the housing, a seal is used to prevent the leakage of air. This seal may be of the packing gland mechanical-seal type employing a spring to press two very smooth surfaces together sufficiently tight to prevent passage of air or liquid.

External Gear Pump

A second type of gear pump is known as the external gear pump. This differs from the internal gear type in that the gears are set side by side in the housing rather than having one gear located within the other. Gears of this type of pump, by meshing together, separate the inlet port from the discharge port. The flow of oil is from the inlet side of the pump to the discharge side generated by the oil being trapped between the spaces of the gear teeth and the sides of the pump housing. Like the internal gear pump, one gear is attached to the propelling shaft and is called the driver or rotor. The other gear is called the idler. In some of the more expensive pumps, both gears are power driven.

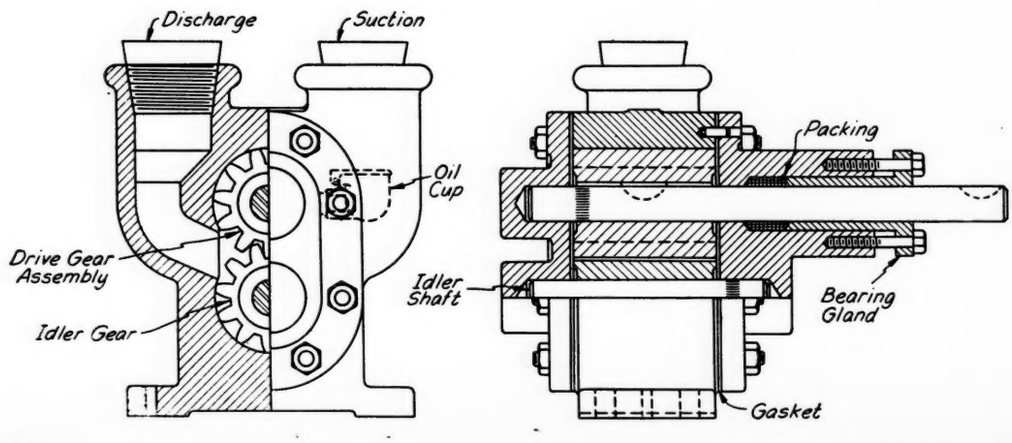

Fig. 1. Details of an external gear pump.

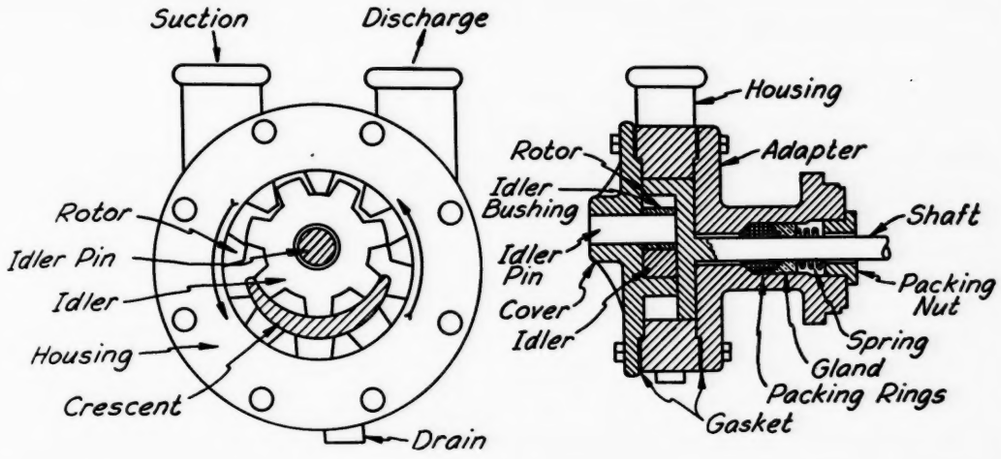

Fig. 2. Details of an internal gear pump.

Pumps for handling Bunker "C" or No. 6 oil must run at reduced speeds to avoid undesirable cavitation, a condition that develops when a displacement mechanism is run at a greater speed than the liquid, which it is pumping, can flow. Cavitation results in the wearing away of a metal surface through pitting. To prevent cavitation the pump must be slowed down to the speed at which the liquid can keep up with it. Heavy fuel oil pumps should be selected to operate between 200 to 400 rpm with 400 rpm as an absolute maximum. Gear pumps for oil burner work are generally electrically driven. Power is transmitted by worm and worm gear, by pulley and V-belt drive, or by chain and sprocket drive. Pumps handling distillate oils may operate at 1,750 rpm or greater.

The fuel oil pump is an integral part of the pressure atomizing burner. The horizontal rotary cup burner may have the pump built integral with the burner or it may be of the gravity type requiring the service of a separate pump set. The integral pump has a very decided advantage in that it simplifies the installation and reduces the initial installation cost. However, there are conditions encountered where the separate pump set is necessary.

Where the suction will exceed 100 ft in length, or where the suction lift will exceed 12 ft in height, it is advisable to use a separate pump set to circulate the oil to the burner. This pump set should be located at the storage tank in a pump house or pump pit. Where there are several burners in one boiler room, the use of the separate pump set will simplify the outside piping to the storage tank and will reduce the cost of installation. In place of several suction lines —one to each burner—only one suction will be required and one return line to the pump set. The pump set discharge is looped past all burners and back to the

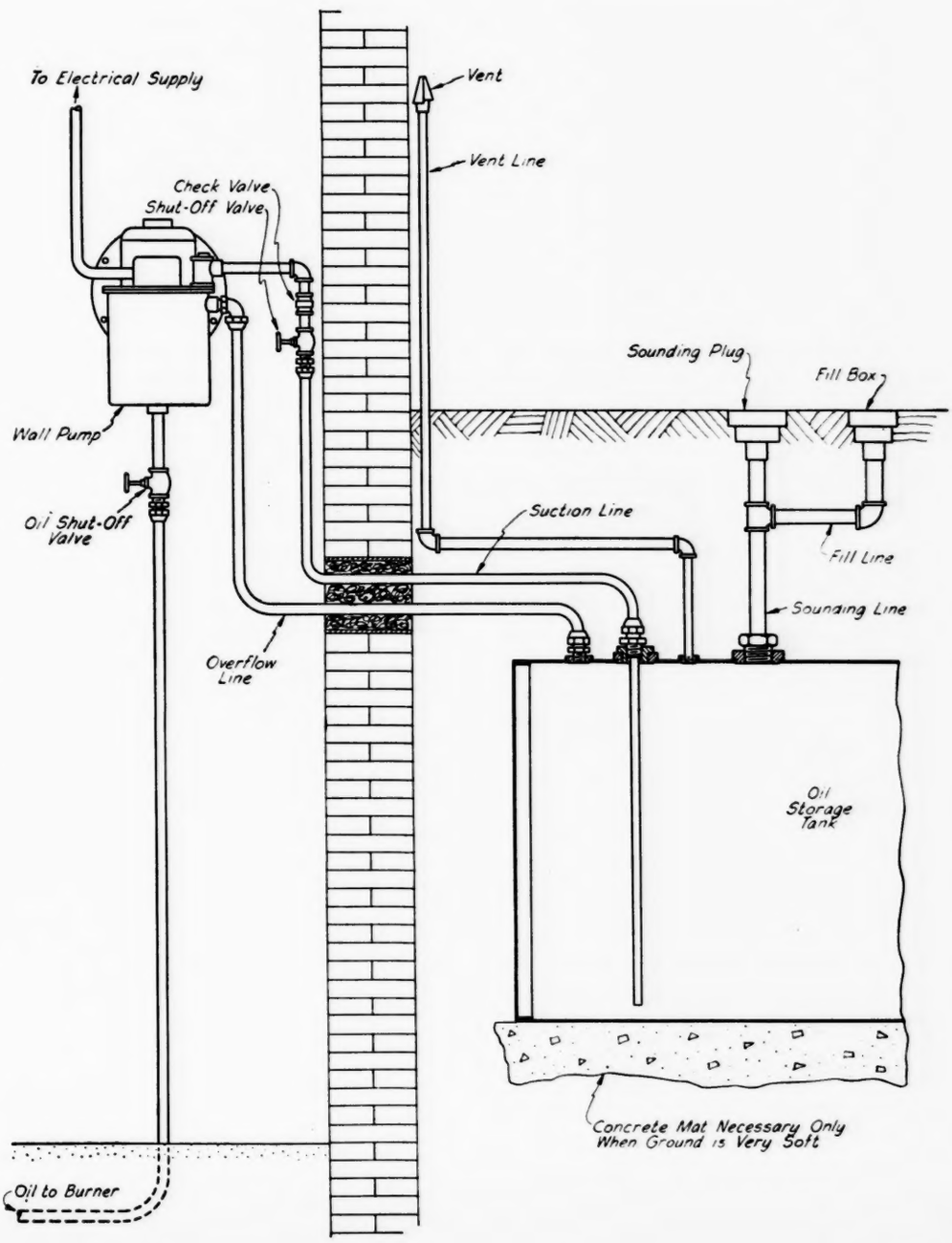

Fig. 3. Typical installation showing outside storage tank with wall pump.

storage tank. When the burners are equipped with integral pumps, the oil is pumped out of this circulation loop and the oil in excess of the burning rate is discharged back into this same line where it is returned to the tank. When burners are of the gravity type, a pressure regulator is installed in the return line to the tank to build up a back pressure to force the oil through the orifice to the cup.

Integral oil pumps generally have a capacity of 1½ to 2 times the burning rate to assure an ample supply of oil at the proper pressure to the nozzle or cup, and also to provide a circulation of oil back to the storage tank. This is very important when using residual oils requiring preheating. A separate pump set should have a capacity of at least 1½ times the maximum burning rate of the total of all the units it is supplying. Every fuel oil pump must be protected by a strainer on the suction side and a relief valve on the discharge side. Relief valves are generally set to discharge at 100 lb pressure.

Vacuum Gage

A very important but inexpensive item to be included with the fuel oil pump is the vacuum gage. Although trouble in pumping is very often attributed to the pump, in most cases the trouble is elsewhere. A vacuum gage, properly located, will eliminate any guesswork and will determine very quickly whether the pump is at fault.

For best results it is advisable to use two vacuum gages as a permanent part of the system. One gage should be located in the suction line just before the strainer while the other should be located between the strainer and the pump. A very high reading of from 20 to 25 inches of mercury will indicate that (1) the strainer needs cleaning, (2) the oil is too heavy, or (3) the suction line is completely or partially blocked. A zero reading will indicate: That the pump is worn, that a packing may be leaking, the pump drive is not operating, or there may be a leak in the suction line. If, upon closing the valve between the tank and the strainer, the vacuum increases from a low reading to around 25 inches, then the pump is operating satisfactorily and the trouble is in the suction line.

Separate fuel oil pump sets for oil burner work are generally driven by electric motors. A motor starting switch or linestarter providing overload and low voltage protection is used with each pump set to start and stop the motor. The linestarter may be equipped with start and stop push button for manual operation, or it may be automatic and operated by the oil burner control system.

Domestic oil burner installations make use of the wall pump when a separate pump is necessary. The wall pump is used with many gravity type burners where the storage tank is below the burner and the oil will not flow by gravity. In addition, it is used with pump-equipped burners where the suction line is of exceptional length or where the suction lift is sufficient to impose a hardship on the burner pump.

The wall pump, Fig. 3, is completely self-contained for automatic operation, and has its own motor, pump, strainer, tank, and switch and float mechanism. A head of oil is automatically maintained in the pump at all times by a float controlled mercury switch. The switch is of the three-point type, that is, it breaks contact at its high point, makes at its middle point, and breaks at its low point. In ordinary operation, the float moves with the liquid level in the tank from the high point, where the motor is "off," to the middle point, where the motor is turned "on" to refill the tank. This action is controlled by the top float. A bottom float controls the low point or safety cut-out. Should the fuel supply become exhausted or for some other reason fail to keep the tank full, the bottom float will turn off the current.

The pump is easily installed. It is equipped with a bracket with rubber bushings arranged for wall mounting. These successfully prevent transmission of vibration to the house walls when properly installed. The pump has three pipe connections: intake, overflow, and feed-line to the burner. The pump should, therefore, be installed sufficiently above the storage tank to enable gravity flow from the overflow back to the storage tank. Most wall pumps are guaranteed to provide a suction lift of 25 inches of vacuum or a safe vertical lift of 20 ft. Wall pumps are designed to handle oils of 24 deg A.P.I. or lighter.

Dry-Ice from Boilers

By-product steam and by-product power are common in the terminology of process industries, depending upon whether power or steam is the primary objective of generation. But it is unusual to find steam a by-product of the process itself. This, however, is the case in the manufacture of "dry-ice" from CO_2 in the flue gases by the Girbotol process, as conducted at the Chicago plant of Pure Carbonic, Inc., one of the largest suppliers of dry-ice.

The boiler installation, put in last spring, consists of one 30,000-lb per hr and two 15,000-lb per hr Combustion Engineering Type VU steam generators burning coke breeze on Coxe traveling grate stokers with oil as a standby fuel.

It was recently decided to conduct a test to determine equipment capacity with a view to increasing the daily output. Accordingly, the test was carried on for a period of two weeks with the largest boiler operating at a load 20% in excess of its maximum continuous rating, during which time the CO_2 ranged from 17 to 18% with a corresponding efficiency of 65%. When it is considered that this efficiency concerns the by-product steam output alone and that the primary product is maximum carbon dioxide, with extraction up to 90%, the exceptional performance of the steam generating unit is then more easily understood.

Visual inspection of the boiler, when taken off the line at the conclusion of the test, indicated less slagging than is experienced under usual operation and no adverse effects upon the refractory parts of the setting.

Air Conditioning in the Production of Pharmaceutical Products

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Controlled air conditions are important in maintaining quality standards in the manufacture of pharmaceutical products. Data are presented regarding the manufacturing processes involved that a better understanding may be obtained of the air conditions necessary for the various rooms or processes.

THE pharmaceutical industry has expanded very rapidly in the past 15 years. During this period of rapid growth, it became necessary to borrow ideas, utilize procedures of the chemical and food industries, and call on the technical assistance of the engineering profession. The industry learned quickly that it could not simply move into any existing structure, install equipment and start to operate economically. Our buildings, our equipment, our lay-outs demanded exacting engineering design to permit profitable operations in a competitive business.

The industry first began handling hygroscopic materials with very crude aids. Boxes, and even rooms, were dehumidified by pans of calcium chloride or other desiccants; or by the use of highly inefficient and dangerous carbon and calcium chloride tanks that were regenerated by driving out the moisture with a flame. In the early dehumidifying methods, no temperature control was attempted.

Extracts of glandular products, certain plant parts, and many chemical drugs are extremely hygroscopic and frequently, as they were more highly refined, they became increasingly hygroscopic and unstable toward moisture. In the early days of these extracts, since the demands were modest and runs were small, they could be handled in small lots. With increased knowledge of the uses of these drugs and subsequent growing demands for them, the requirements of controlled moisture and temperature conditions became greater.

With the first use of humidity control, many applications became apparent. Air conditioning and humidity control has now become one of the most important tools in the drug manufacturer's plant. The quality specifications for drugs and biologicals are becoming more rigid each year and controlled air conditioning is of paramount importance in enabling the industry to meet and surpass these quality specifications.

Fig. 1. In this tablet coating room, conditioned air is supplied to the tablet coating pans. Separate hot and cold air ducts are connected to a common feed for each pan to speed drying.

Aseptic Operations

The preparation of sterile solutions and powders for parenteral use are today carried out in air conditioned areas. While the degree of dehumidification here need not be great, temperature and humidity should be uniformly constant. Conditions for most sterile operations need not be too rigid unless the operations are concerned with hygroscopic materials. Satisfactory conditions are 50% R.H. at 75F. All of the factors that make air conditioning important for comfort reasons in other operations are magnified in cases where individuals are concerned with aseptic operations. Air conditioning for this type of work requires specific considerations:

(1) The supply air must be dust free. Air-borne bacteria or spores are carried on dust particles. Therefore, to approach sterile air, we must remove the dust that carries these organisms. The use of filters is, of course, essential for the removal of the majority of the dust. These should be the best type of commercial filters. Viscous type filters, and certain types of electrostatic filters are advantageous. In certain installations, the use of banks of ultraviolet sterilizing lamps have been employed to aid in decreasing the bacterial count in the air.

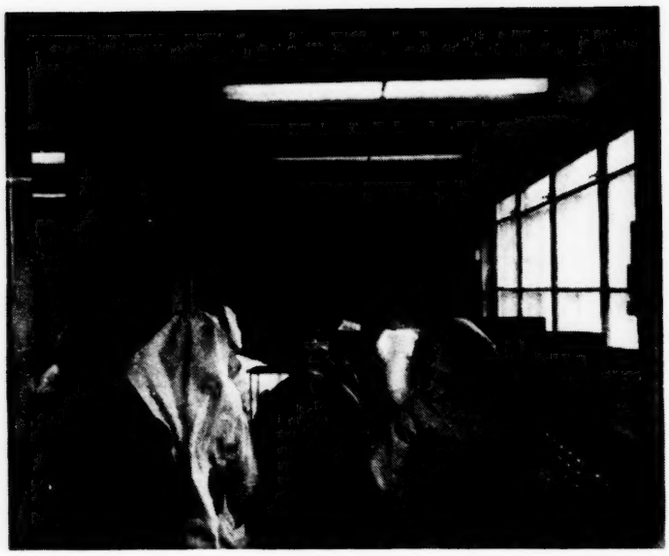

Fig. 2. View of a powder-filling room where controlled sterile air conditions are maintained.

These lamps are installed in the duct. However, since the length of exposure and intensity of exposure in a rapidly moving stream of air is probably low, the efficacy of this type of installation should not be considered to be more than an aid to reducing bacterial count. They must, of course, never be used without filters or used ahead of filters. The use of sterile lamps in the area itself is a widespread practice. In these cases, the lamps are installed on the ceiling or walls of the sterile rooms and are an aid in keeping this bacterial count low. The efficacy should be greater within the area than when used in the duct since air velocities are so much less. Blood-agar plates are periodically exposed for one-half hour or one hour, incubated, and the colonies of growth are counted. This test is often an indication of dirty filters, poor filters, or dirty ducts. Vapors of propylene glycol may also be introduced into the air stream in the duct to reduce the bacterial count in the air.

(2) Ducts should be designed to permit cleaning in the horizontal runs.

(3) Sterile rooms and areas should have a minimum of turbulence in the air. The size, design and location of air diffusers should be such as to reduce turbulence to a minimum. The rooms should be kept under a slight positive pressure to insure against dust entering from the outside. Doors should be loose fitting and return ducts should be placed in corridors leading to these rooms to reduce turbulence in the rooms.

Tablet Manufacture

The manufacture of a compressed tablet entails the milling of powders to uniform fineness, mixing together intimately, and the formation of this mixed powder into a granular material that will flow freely and uniformly into the dies of a tablet compressing machine. The operation can be broken down into the following steps:

(1) Milling and mixing.

(2) Wet granulation*—moistening of mixed powders and breaking wet mass into granules through a screen.

(3) Drying of granulation to uniform moisture content.

(4) Screening, blending and lubricating of dried granulation.

(5) Compression of the granulation into a tablet.

Steps 4 and 5 are very advantageously carried out in an air conditioned area. In the case of many drugs that are tabletted, this is an absolute necessity.

Tablet granulations, in most cases, are found to compress best when they contain from 1-3% moisture. Screening and blending operations, by their very nature, cause extreme surface exposure of granules to the atmosphere. It is during these operations that moisture may be absorbed into the granules causing subsequent difficulty in compressing. The compressing operation may cause difficulty on a slightly moist granulation due to sticking of some granules in dies or on punch faces.

Ideal conditions in a tablet compressing room are from 35% R.H. at 80F to 50% R.H. at 75F. These conditions will permit handling of practically any materials during tabletting. There are substances which require the very rigid conditions of 5-10% R.H. at 80F to permit long runs to be made safely.

The compressing room should certainly be air conditioned. The punches and dies which are used in forming the tablet are fabricated of tool steel and are highly polished. The effect of moisture on these is to quickly corrode, dull and pit the faces of these punches and dies. The savings to be realized in prolonging the life of these pieces is an important economical consideration.

The designer of air conditioning for a tabletting department must recognize the importance of handling dust in these installations. Many of the products handled are extremely valuable and must be salvaged from the operation. Since we will be using conditioned (dehumidified) air through the dust collectors, provisions for cleaning the air thoroughly and perhaps cooling the air should be part of the design problem considered at the time the air conditioning is designed. Since a tabletting department is usually handling several different materials at a time on different machines, individual collectors should be used at each machine. The suction operating these individual collectors can be centralized to all of the collectors, but this central system must have adequate filters since many of the drugs handled may be toxic. They must be removed from the air before it is returned to the air conditioned room.

While certain substances cannot be dried at elevated temperatures, it has been found that these materials can be dried at room temperature using dehumidified air. This can be accomplished by drying cabinets supplied with dehumidified air. These cabinets can be operated in the temperature range of 70 to 85F very successfully.

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*In certain procedures, the wet granulation step and drying step are replaced by a dry granulation procedure.

Tablet Coating

Tablet coating, Fig. 1, is the process of covering tablets or pills with a series of coats of inert substances ending with a final sugar coating to protect tablets from moisture or air to prevent decomposition of sensitive materials. They are also used to conceal unpleasant-tasting drugs and chemicals. The coated tablets are finally waxed and polished to make them smooth and shiny. This operation is completed by rolling the tablets in pans and adding a small amount of syrup or gelatin solution, then coating powder, and blowing variable temperature air over them until dry; then giving them subsequent coats in the same manner until the desired coat thickness has been obtained. The number of coats applied to a tablet will vary with the operator, the type of tablet being coated, and the nature of the coating material. It may vary from 20 to 30 coats. In some cases, over 40 coats may be used. Frequently some medication is put in the coats, when, for reasons of chemical incompatibilities, this drug cannot be put in the tablet itself.

Drying in ovens is done between several series of coats. It is obvious that in the case of tablets of a hygroscopic material, each coat must be quickly dried before the moisture is absorbed into the tablet itself. The use of dry air speeds up this operation and improves the coat. Air can be taken directly from a dehydrator ahead of the cooling coil. When this air is taken from a Lectrodryer, the temperature of the air will be from 140-160F; this air is split—part of the supply is directed over a cooling coil to drop the temperature in the range of 70-80F. The two air supplies (hot or cold) are fed to the coating pan through a mixing duct. Dampers in the hot and cold air ducts permit the operator to vary the temperature of the drying air over a wide range to suit his needs. The moisture content of the air coming off the dehydrator is approximately one grain. Therefore, the capacity of this air to pick up moisture is tremendous.

The use of hoods over the pans cuts down the dust in the coating department in a remarkable degree and also reduces the moisture load into the room. Conditioning of the coating and polishing room, which should be more than comfort conditioning, aids materially in the coating of tablets. About an ideal condition would be 35% R.H. at 80F. Coated tablets, when exposed to moist air, will rapidly lose their high gloss. This is true both in the coating department and in the inspection, filling and packaging room.

Capsule Manufacture

Another form of medication is the gelatin capsule. There are two types, namely, the hard shell or slide capsules and the soft shell capsules. The hard shell capsules are preformed gelatin shells which are opened, filled with powder, and closed on a filling machine. The soft shell capsules are formed from two moist gelatin sheets by the plate method or on a rotary type machine. These are usually liquid filled or filled with a suspension of a powder or mixture of powders in a vegetable oil.

Gelatin can readily absorb moisture from, or lose moisture to, the surrounding atmosphere. If capsules

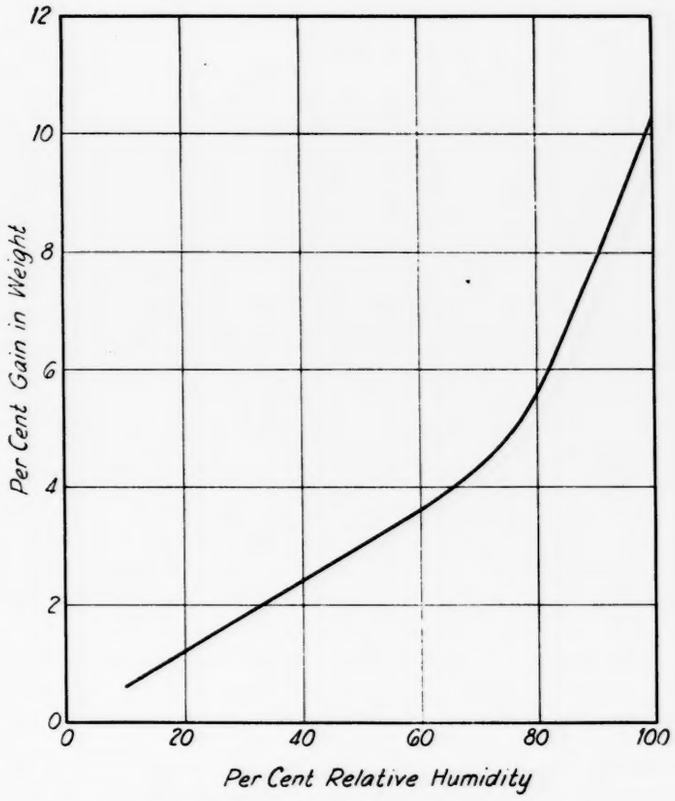

Fig. 3. Typical moisture pick-up curve of a tablet material for exposure to various humidities.

are stored or handled in too dry an atmosphere, they will lose moisture and become hard and brittle. If they are exposed to a moist atmosphere, they will absorb moisture and become very soft and difficult to handle. The success or failure in manufacturing or handling gelatin capsules often depends on the conditioned air in which they are handled. Frequently areas in which filled capsules are held in bulk storage are air conditioned. Conditions of 40-50% R.H. at 75F have been found to be advantageous for storage of finished capsules. Empty capsules that have been stored in too moist an atmosphere can be brought back to an ideal state by exposure to ideal conditions for a period of time. Conversely, if capsules have been allowed to become dry and brittle, they may be brought back to an ideal state by exposure to moist conditions for a period of time.

The author has seen air conditioned areas where relative humidity and dry bulb temperature are variable over a rather wide range used for experimental purposes with great success.

Packing and Filling

Air conditioning in filling and packing rooms, Fig. 2, is rapidly becoming standard in the industry. The conditioning here should be to a definite humidity and dry bulb temperature—not just differential conditioning. The R.H. chosen for a packing room depends upon the product to be handled. In most cases 35% R.H. at 78-80F for most tablets and capsules is ideal. An excellent general condition for many general purposes is 50% at 75-80F. Many products can be handled most efficiently at 5-10% R.H. at 80F.

The question has often arisen as to the effect of

these low humidities on the health of the operators. The author has seen rooms in operation over a period of years in which operators, both male and female, have worked for eight hours per day the year-round at a relative humidity of 5% at 80F. The incidence of respiratory disorders and lost time due to illness in these groups has never been any greater than groups working in other less dry areas.

Bottles, when brought into a plant from outside, may frequently develop a film of moisture due to condensation. Holding these bottles in the air conditioned packing room often brings them into equilibrium conditions with the product to be filled and thus eliminates some difficulties both with the product going into the bottle and during labeling operations on the bottle.

High speed labeling and packaging machines operate better with labels and cartons that are held in the air conditioned packaging room or stored in a controlled humidity area prior to use, since paper and board will readily pick up moisture.

Animals

Animal houses and animal colonies, and laboratories in which animals are used, are now almost universally air conditioned, particularly in the case of small animals, such as mice, rats and guinea pigs. These animals are very susceptible to pneumonia when exposed to temperature or humidity changes. Animals on test may represent a large investment in time and materials and the loss of these animals through colds and pneumonia can seriouly hamper and delay a project. Ideal conditions for these animals are 50% R.H. at 77-80F. While 60% R.H. is satisfactory, the temperature must be uniformly maintained.

General

Access to low humidity rooms or areas should be through air locks to prevent loss of dry air when doors to areas are opened. The air lock preferably should be made sufficiently large to permit pallet trucks or supply trucks to enter the lock, and have the outer door close before the inner door is opened. The doors should be sufficiently far apart and located so the individual handling the trucks cannot hold both doors open at one time.

In operations where extremely low humidities must be maintained, a stand-by dehydrator may be extremely useful for several reasons.

Equipment is usually operated 24 hours per day, seven days per week. During maintenance operations on a unit, or during a breakdown of a unit, conditions may be maintained in the area by means of the stand-by unit. During the extremely humid days when the equipment may be overloaded or when excessive loads may be imposed on the system from the operations, the stand-by unit should be so designed that it can be put in series with the regular unit to increase the capacity of the system.

In extremely dry areas and during peak loads on the most unusual summer days, additional burden may be imposed on the system by transmission of moisture through walls and partitions of buildings. The vapor pressure difference between air at 120 grains and air on the other side of a partition at only a few grains

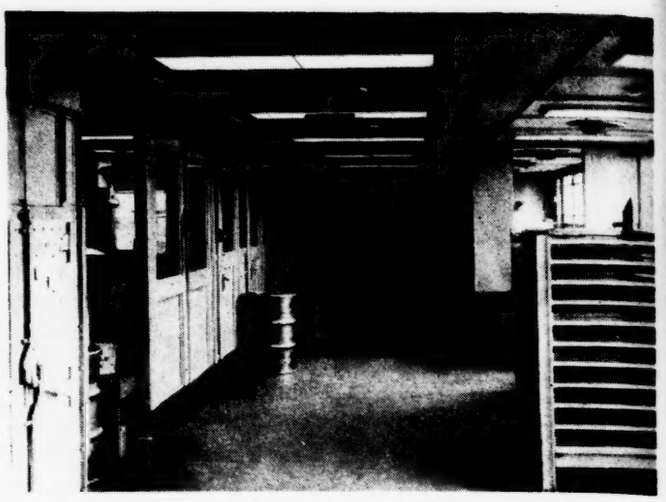

Fig. 4. Corridor into which the sterile rooms open.

apparently can cause even a well designed system to fail to deliver design conditions. In such cases, it may then even become necessary to metal line the walls of a room.

Maintenance of systems and filters should be periodic and regular. It is well to have a record card hung on equipment ducts and filters, indicating date of maintenance, cleaning or changing of filters or testing of sterile lamps, and the date of such work. These records should be checked by the operating men as well as engineering and maintenance departments.

The design of duct work should take into account the desirability of access doors to the duct to permit cleaning of ducts. In systems supplying air to areas having dusty operations, there should be filters in the return ducts. Frequently certain dusts will build up on dryer beds or in Kathene solutions to decrease the efficiency of these beds or solutions. Often the reason is not immediately apparent. The designer of the system should take into account the extra resistance introduced by these filters.

If a system is to be designed for supplying an area handling a particular material, the designer should familiarize himself fully with the nature and peculiarities of the material. He should obtain curves or data showing the moisture pick-up of the material at various humidities and on exposure for various times. A typical moisture pick-up curve for a tablet material is shown in Fig. 3.

The design of buildings to house pharmaceutical operations and the necessary air conditioning to service these operations should always be done with the following basic idea in the mind of the designer:

The pharmaceutical industry is a rapidly expanding industry. The products and requirements change from day to day. Often a room or area that has been perfectly designed to service an operation which requires 10 operators in the room and has a heat load from a certain number of motors and other heat sources may, within a year, be turned over to an entirely different operation that requires 20 operators and has two or three times the heat load from equipment. One of the finest tools the engineers can give to the pharmaceutical manufacturers is carefully designed air conditioned areas whose air conditioning is flexible enough to permit drastic changes in conditions and loads.

Fig. 1. A radiant-acoustic ceiling in the pipe mill office of National Tube Co.

Design of a Radiant-Acoustic Ceiling

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In order to superimpose acoustical treatment on a radiant ceiling panel already in place, some originality and close calculation are brought to bear.

PROBABLY the most efficient area in future commercial buildings will be the ceiling area. It can be efficient because the radiant panels, the lighting fixtures, the acoustic tile, and the fire protection equipment can be installed in the ceiling; the floors and walls can be used entirely for their basic purposes.

Heretofore the acoustic treatment made ceiling heating panels impossible. The thermal insulating properties of acoustic tile made it impracticable to place radiant heat sources behind the tile, and the acoustic problem made it mandatory to treat the ceiling.

One of our office buildings had a radiant ceiling installed and operating when it was decided to *add* acoustic treatment, and to provide forced ventilation for both summer and winter conditions. Infiltration was not enough to clear the cigarette smoke from the large room shown in Fig. 1.

Here was our problem: Increase the ventilation load and at the same time treat the radiant ceiling with acoustic tile.

The first phase of the problem was easy. We could temper the ventilation air with steam coils. This would take the ventilation load off the panel. The second phase of the problem was different. How could we treble the thermal resistance of the panel and still maintain over half of the heat output? The ventilation load had previously represented 41% of the load, but removing it by tempering the air still left 59% of previous rating to be carried by the panel after acoustic treatment. We knew that conventional acoustic applications would treble the thermal resistance. Therefore, to get 59% of the load through 300% of the resistance meant raising the temperature difference (between water and panel) by 177%. This was, of course, impossible. To further complicate things, we were told that the temperature difference could not be increased at all!

After a study of the acoustic problem, the idea of an egg-crate ceiling seemed most promising.

It was decided to use a cell roughly 24 inches square and 6 inches deep, where the vertical sides were of acoustic tile and the ceiling was left open (see Fig. 2). Actually, the cell was so defined because of the heating problem, not the acoustic problem; the analysis will be given later.

It seemed likely that the cell would have an acoustic effect depending upon its shape. The deeper the cell the greater the effect, but if the cell were sufficiently shallow the effect would be negligible. Following is our assumption of the acoustic effect of our particular cell.

If a unit of sound energy, originating on surface 4

[1]U. S. Steel Corp. Subsidiary

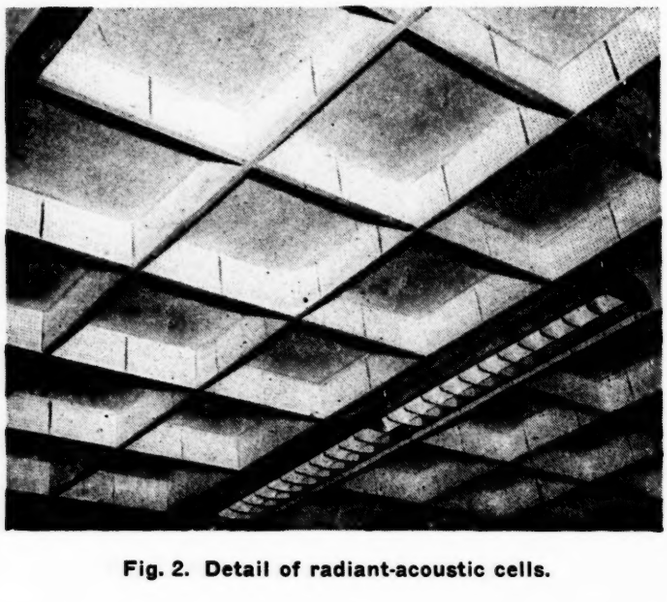

Fig. 2. Detail of radiant-acoustic cells.

(that is, within the room) in Fig. 3, enters the acoustic cell, it has a probability of 0.4 of returning to surface 4 without striking an acoustic tile. That probability is determined from the solid angle of surface 2 as subtended by surface 4 which is

$$P = \left(\frac{1.2640}{2.0000}\right)^2 = 0.40 \qquad \text{See Table 1}$$

The probability of this unit striking an acoustic tile is $1 - 0.4 = 0.6$.

The future of this 0.6 probability is the gist of our problem. By similar reasoning, we may say that the probability of the energy returning to surface 4 (the room) after leaving an acoustic tile is 0.60. Arrows A, B, C, D, E in Fig. 3 show possible paths of travel.

Once the energy strikes a tile some of the energy will be absorbed, some will be transmitted to the other side and some will be reflected. The manufacturers state that the amount of energy absorbed when this perforated tile is hung in our cell is 0.65 of all the energy striking it. Let $e = 1 - 0.65 = 0.35$ represent the amount of energy that leaves the tile for further travels, and let E_r represent the summation of energy that gets back to the room afer reflection from the various surfaces.

To evaluate E_r, we can develop a series function, assuming the sound enters the cell with unit energy. We have shown that 0.40 of this unit will return to the room without contact with the tile. This, then, is the first term of our series.

Of the remaining 0.60 unit, which does contact tile, a fraction, *e*, will be reflected back into the cell. The probability that this reflected energy (0.60e) will return to the room is 0.60. Therefore, the second term of our series will be $0.60e \times .60 = .36e$.

There will be a remainder of reflected energy in the cell of $0.60e - 0.36e = 0.24e$ which will again contact tile. Of this, the fraction *e* will be reflected leaving an amount of energy $0.24e^2$ with a probability of 0.60 of returning to the room. Thus the third term of our series will be $0.24e^2 \times 0.60 = .144e^2$.

By this reasoning, our series becomes:

$$E_r = 0.40 + 0.36e + 0.144e^2 + 0.0576e^3$$

if we let H = probability of a hit = 0.40

M = probability of a miss = 0.60

Then summation of our series can be written

$$E_r = 0.40 + \frac{M^2 e}{1 - He} = 0.55$$

The equation for E_r is for this cell shape only. If 0.40 is replaced by *first* miss probability then the form is good for *any* cell.

If $E_r = 0.55$ then we may state that the cell can be replaced *by a flat surface of absorption 0.45.* We make that statement because the equation of Sabine (the classical acoustic equation) is derived on flat surface treatment, and we wish to make use of that equation. The equation for noise reduction is:

$$R = 10 \log \frac{A_t a_t + A_u a_u}{A_u a_u}$$

Where

R = noise reduction in decibels

A_t = area of acoustic tile

a_t = absorption of acoustic tile

A_u = area of non-treated surfaces

a_u = absorption of non-treated surfaces

For our particular room (based on 1,560 sq ft of ceiling and $a_t = 0.45$), R = 5.2 decibels.

How does this compare with a conventional system? Actually the $a_t = 0.45$ is a good value to use for perforated tile cemented to a ceiling; we shall use this as one model because we know the pleasing acoustics that such a ceiling would develop.

In this arrangement, we could cover all the ceiling except the lights. (There would be no borders as

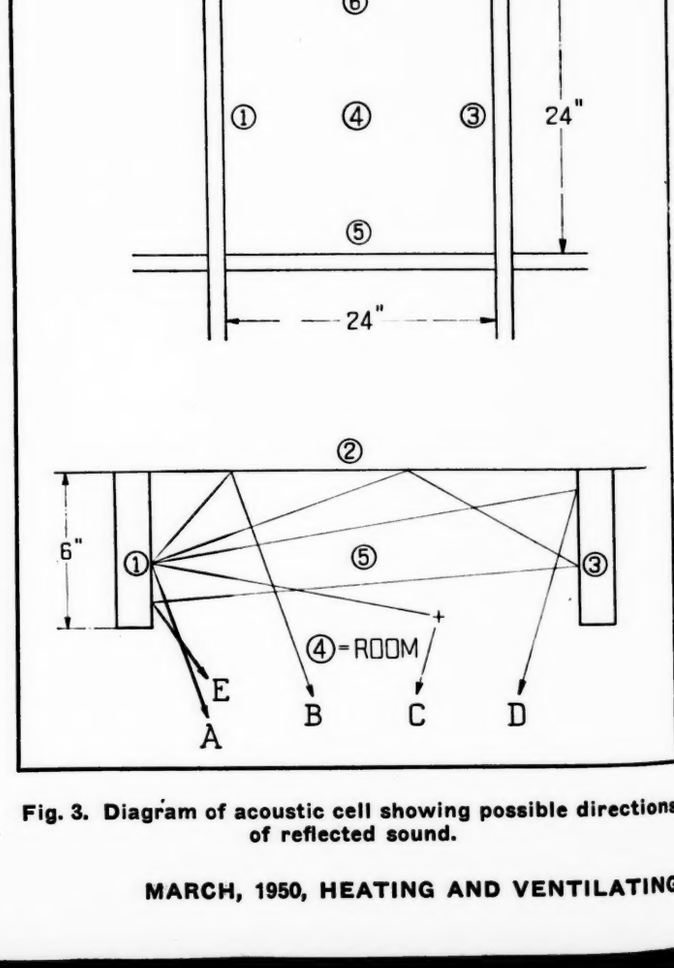

Fig. 3. Diagram of acoustic cell showing possible directions of reflected sound.

shown in Fig. 4.) With this fully covered ceiling, R = 6.4 decibels.

We are now perturbed. Our pet theory has dropped in prestige and we are no longer sure we can do the job. Acoustic experts tell us we are on the border of acoustic acceptability. To pad our margin we requested the installation of side panels (Fig. 4). This would change our noise reduction to 5.4 decibels. This slight increase over noise reduction of the egg-crate ceiling alone is hardly worth the cost, but it was decided to install the side panels anyhow.

All that now remained was to put the tile in place. Fig. 1, 2, and 4 show the installation process in steps, and the final appearance.

The last step was to compare the results with the prediction. The acoustic contractor performed "before-and-after" tests and stated that

$$R = 5.2 \text{ decibels}$$

which agrees within 4% of our prediction. Incidentally, the calculations shown were for a room with desks etc., but with no occupants, which were the conditions of the tests.

A reduction of 5.2 db in a room with an original noise level of 60 decibels (which was about our level) will reduce the noise about 30% as determined by ear. There is a complicated equation for computing this, but it is of no particular interest here.

Incidentally, a majority of the workers were satisfied with the acoustic results. About 90 workers are in this building and all offices were so treated.

The performance of the radiant heating ceiling panel is, of course, affected in direct proportion to the thermal resistance. Thermal resistance here, however, would involve shielding by the cells. When the architect designed this building, he decided on using full ceiling areas and thereby using lower water temperatures. The landlord of this building refused to let us raise the water temperature in the coils, so with the ventilation air being tempered to comfort temperature, we redesigned the coils.

TABLE 1—SOLID ANGLES SUBTENDED BY VARIOUS SURFACES
(With reference to Fig. 3)

Surface	With Respect to Surface	Solid Angle Steradians
2, ceiling	1	0.738π
3, tile	1	0.122π
4, room	1	0.738π
5, tile	1	0.201π
6, tile	1	0.201π
	Total	2.000π
1, tile	2	0.184π
3, tile	2	0.184π
4, room	2	1.264π
5, tile	2	0.184π
6, tile	2	0.184π
	Total	2.000π

Example: Of the 2π steradians of solid angle to be "seen" from surface (1), 0.1220π steradians are obscured by surface (3).

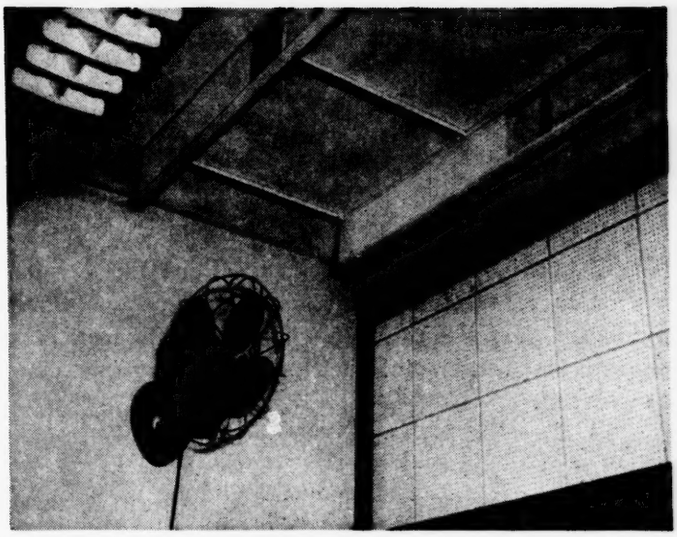

Fig. 4. Detail of assembly, showing untreated borders on ceiling and supplementary acoustic tile on walls.

It was found that the room shown in Fig. 1 was the critical room, and that 59% of the ceiling panel would do the job with the proposed ventilation system. The problem of determining the added thermal resistance was similar to the problem of determining the acoustics of the cell.

By referring to Table 1 and Fig. 3 we see that only $\frac{1.2640\pi}{2.0000\pi} = 63.2\%$ of the energy leaving the panel will enter the room without first striking the cell walls. Actually the acoustic material will reflect some of the energy and re-radiate some energy, but we do not want to count on either quantity. Both will probably decrease as dust and smoke particles are deposited. We can rely on reflected energy as a small safety factor. The re-radiated energy becomes significant only after hours of operation, but from a control standpoint we are dependent upon minimum time-lag.

Our effective area, then, will be taken as 63.2% of the cell ceiling area, or 990 sq ft of panel area plus the panel area that borders the cells, which is an additional 390 sq ft. This area of 1,380 sq ft represents 61% of the original ceiling. This is ample since we needed only 59% and we have the added value of the reflected energy. Note that we allowed for the area actually occupied by the lighting fixtures and the cell walls, a total of 14.5% incidentally.

This 61% capacity can be expressed as an increase in thermal resistance to the panel. In other words, for identical water temperatures the *entire* ceiling can still emit at least 61% of its original capacity; therefore, we can consider the resistance to have increased 39%.

By introducing the ventilation air at comfort temperature, we can provide the required heating with the original panel area and boiler water temperature, which is what we started out to do. Although only a partial heating season has been completed, the heating problem seems to be satisfactorily handled. Further data will be obtained throughout this season.

Welding Stainless Steel Pipe

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Part 2 of this two-part article describes the various processes for welding stainless steel pipe. Part 1, published last month, gave basic information regarding the welding of such pipe and factors to be considered.

MOST of the fusion welding processes can be used to weld the stainless steels although some are considerably more adaptable than others. These processes can be broken down into two basic categories, manual and automatic welding. Manual welding can be used anywhere and accounts for the bulk of stainless steel welding. Automatic welding is necessarily limited to welding in the shop or in those few field locations where conditions permit adequate equipment to be set up. Even under ideal welding conditions, automatic welding is economically applicable only to certain types of welds and where work of a repetitive nature is encountered.

Manual Welding

Oxy-acetylene welding is probably the first manual welding process that comes to mind. Here the heat produced by the combustion of acetylene with oxygen is concentrated on the pieces to be joined causing fusion; metal is added by means of an uncoated welding rod. Oxy-acetylene welding does not produce welds satisfactory for most stainless applications. It is an operator-controlled process, which greatly increases the possibility of poor welds. Stainless steel is very sensitive to either oxidation or carburization, which means that the flame must be kept neutral, a situation not easy to obtain. It is generally agreed that a flame very slightly on the reducing or carbonizing side of neutral is preferable to an oxidizing flame.

Illustrations, Courtesy The Linde Air Products Co.

Fig. 1. Mechanized Heliarc welding used in a stainless steel tube mill.

It was previously mentioned that the 18-8 stainless steels conduct heat at about one-half the rate of carbon steel and expand about half again as fast due to heat. Because a relatively long time is required to obtain fusion with oxy-acetylene welding, and the dissipation of heat is slow due to the nature of the base metal, the zone adjacent to the weld is held in the critical carbide precipitation temperature range for rather long periods, a decided disadvantage when maximum corrosion resistance is desired. Also this condition of prolonged critical temperature, in combination with high expansion coefficient, tends to cause excess distortion. Gases resulting from the combustion of the welding flame are supposed to act as a protecting blanket to prevent oxidation, but it is generally felt that the protection afforded is inferior to that provided by the inert gases used in the inert-arc process or by coated electrodes. In general, oxy-acetylene welding is not recommended, especially for maximum corrosion resistance.

Probably the process most widely used with stainless steels is the d-c covered electrode arc-welding process. This situation exists chiefly as a carry-over from carbon steel welding and because many welding shops are not equipped to use the newer and better processes, such as inert-arc welding. Used properly, d-c covered electrode arc-welding yields fairly good results, especially in comparison with oxy-acetylene welding.

Arc-welding has the advantage of concentrating the heat only where it is needed. The high electrical resistance of stainless helps to pin-point the heat created by the arc. The limited area of fusion receives only the amount of heat necessary to melt the electrode and the base metal, a condition which tends to minimize the length of time at critical temperature. With d-c, reverse polarity (electrode positive, work negative) is usually used because the hotter end of the arc is at the end of the electrode, causing the electrode to melt more rapidly and to remove the area of maximum heat from the base metal, thereby lessening the possibility of carbide precipitation.

Due to the high electrical resistance of stainless steel, short electrodes are required. Stainless electrodes are commonly supplied coated on both ends but with a short uncoated area in the middle for gripping by the holder. This arrangement combines the economic advantages of long electrodes with the resistivity requirement for short ones.

The coated electrodes used with arc-welding afford much more positive protection against exposure of the molten metal to the harmful oxygen and nitrogen in the air than do the gases of combustion used for protection in the oxy-acetylene process. As the metal in the electrode melts and drops into the puddle, the electrode coating drops with it, forming a shield and a slag which floats to the top of the molten pool and prevents contact with air.

A few precautions must be observed when arc-welding. A steady operator is required. A short arc should be maintained since it can be held more uniformly and gives greater control over the deposition of the weld metal. Generally, grooves of the two pieces to be joined need to be somewhat wider than in carbon steel welding. A weaving technique is to be avoided due to the possibility of the slag inclusions in the weld metal. On particularly wide beads where some weaving is called for, it should be restricted to twice the diameter of the electrode. Of course, extreme cleanliness and proper joint preparation are important, as with all stainless welding.

D-c arc-welding has some disadvantages. There is some tendency to produce spatter, which must be cleaned off to prevent localized attack. Similarly, coated electrodes leave a slag covering the weld which must be removed. Also, at present there is not the wide variety of coatings available as with carbon steel electrodes. However, present-day intensive research by many of the leading electrode manufacturers is minimizing the latter situation.

The use of manual a-c covered electrode arc-welding has been restricted in the past due to the very limited types of stainless electrodes available. Quite recently the research mentioned before has developed electrodes satisfactory for use with a-c current, and this process now seems to be gaining favor. It is claimed that a-c is better for all-position welding than d-c and also that operating costs with a-c are somewhat lower. It now appears that a-c arc-welding will play a more important role in future stainless steel welding than it has in the past, particularly for shop welding. There is still some question as to the economy and feasibility of welding stainless in the field with a-c equipment.

Atomic Hydrogen Welding

Atomic hydrogen welding has been used with considerable success to weld stainless, but its use now is waning for piping work due to the advent of the inert-arc method. In atomic hydrogen welding, the heat of an a-c arc is augmented by heat released by the hydrogen gas. Separating the two tungsten electrodes starts the arc, causing the hydrogen molecules (H_2) to break down to single hydrogen atoms (H+), absorbing considerable heat as they do. When the atoms get beyond the arc, they revert to hydrogen molecules, giving up the heat they absorbed and adding it to the heat of the arc. The hydrogen gas blankets the fusion zone preventing oxidation. Bare filler rods are used where additional metal is necessary. The process has several disadvantages, one being that the great amount of heat developed tends to warp the work. Also, the process is not too adaptable to any but the simplest type of joints. The double electrode torch is relatively heavy, making it somewhat unwieldy. Atomic hydrogen welding is, however, readily adaptable for satisfactory use with repetitive automatic welding.

Inert-Arc Welding

The inert-arc method of welding is a quite recent development, first being used commercially in 1942. In the last few years, it has achieved a reputation which bids fair to make it the chief method for welding stainless steel piping in the future. In inert-arc welding, an arc is struck between the pieces to be joined and a single tungsten electrode while an inert gas, either helium or argon, flows around the fusion zone, shielding it from the oxidizing elements in the atmosphere, Fig. 2. Either a-c or d-c can be used, but d-c with straight polarity (work positive, electrode negative) is recommended for welding stainless steel piping in the thicknesses usually encountered. The tungsten electrode is virtually non-consumable and does not permit carbon pickup. Filler rods are bare and can be of the same composition as the base metal since there is little or no loss of chromium or other important elements in the arc. For manual inert-arc welding, it has been found that argon is slightly better than helium for providing the blanket of inert gas around the weld zone. Argon is heavier than air, is slightly cheaper to use for manual welding, and tends to maintain a more stable arc, particularly when low welding currents are used. Helium gives better penetration and permits higher welding speeds, properties which make its use highly desirable in automatic inert-arc welding.

The inert-arc method of welding possesses several important advantages not realized by any other welding process. It produces welds of greater penetration, even if the edges to be joined are not beveled. In fact, it is unnecessary to bevel the edges of plate up to and exceeding ¼ inch. The puddle is more easily controlled with this process than normal arc-welding. It has been said that inert-arc welding combines the ability to control the puddle inherent in oxy-acetylene welding with the speed of orthodox arc-welding. The greater speed and control result in less overheating in the weld zone and less consequent carbide precipitation. In addition, there is no spatter in inert-arc welding, and since bare filler rods are used, there is no slag to remove from the finished weld. Inert-arc welding torches are well-designed and easy to use.

The puddle in inert-arc welding tends to be quite fluid; consequently when welding in other than the downhand position, the puddle should be kept rather small to insure complete control. If this precaution is observed, the inert-arc process can readily be used

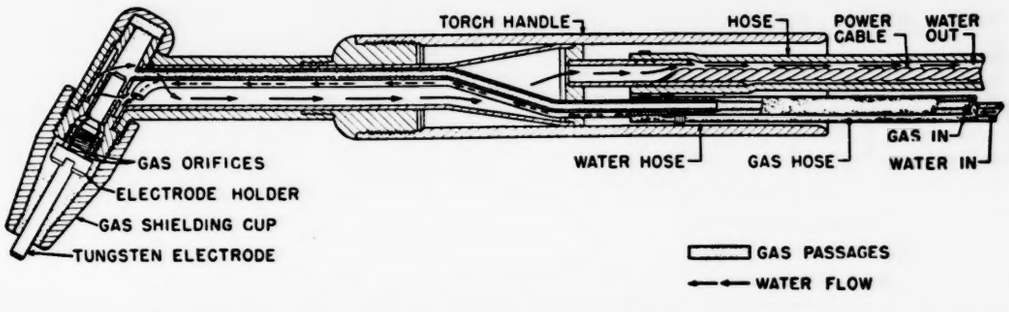

Fig. 2. Sectional view of a water cooled inert-arc welding torch.

for all-position welding. Some minor disadvantages stem from the inert gas used to prevent oxidation. While neither argon or helium are poisonous, they are nevertheless not healthful to breathe, and adequate ventilating facilities should be available in the shop. Also, in order to insure an effective blanket of inert gas, care must be taken to prevent circulating air or breezes from blowing away the gas and thus removing the oxidation preventive. This latter precaution is particularly true when welding out-of-doors. It can be seen, however, that these relatively minor drawbacks are inconsequential compared to manifold advantages of inert-arc.

Automatic Welding

In the field of automatic welding, three methods have been commonly used: Submerged-arc process, atomic hydrogen process, and the inert-arc process. Recently inert-arc welding has largely superseded atomic hydrogen welding so that present day automatic processes are largely confined to the remaining two processes for pipe welding.

Most automatic inert-arc welding is similar to manual welding by the same process, the only difference lying in the design of the torch and with the provision for an automatic means for feeding the filler rod and for moving either the work or the welding equipment. Helium is most commonly used as the shielding gas for reasons mentioned. Quite recently an automatic inert-arc process has been developed which eliminates the tungsten electrode and substitutes a continuously fed stainless steel wire electrode, thus simplifying the process. The latter method has been used quite extensively to weld aluminum and is now being applied very successfully to automatic stainless steel welding. Submerged-arc welding, where the metallic arc is contained by a special granulated powder, part of which fuses forming a slag that prevents oxidation, is also used successfully to weld stainless where the type and number of welds justify the expense of setting up.

It should be apparent that there is no best method for welding stainless steel. The individual problem at hand will determine which process is most adaptable. In general, it can be said that the inert-arc process is gradually being accepted as the most desirable method of manually welding stainless steel piping and that in automatic welding, both the inert-arc and the submerged-arc methods have virtue, the choice between them being governed by the type of weld to be made.

Heat Treatment

Proper heat treatment consists of annealing the assembly by heating to 1,900F, holding it at temperature for a time dependent on the thickest section, and then cooling uniformly to black heat in a maximum of three minutes. This procedure redissolves all the precipitated carbides and puts them permanently back into solid solution, thus insuring maximum corrosion resistance. Pipe assemblies heat treated in this fashion are not susceptible to intergranular corrosion due to chromium deficiency unless they are again exposed to the critical 800—1,600F temperature range. It is possible to use the unstabilized grades with normal carbon if the pipe assembly is properly heat-treated following fabrication.

It is sometimes necessary to stress-relieve welded assemblies, particularly where several beads are required to make a finished joint. It is only possible to stress-relieve the stabilized grades of stainless steel since the heat treatment would subject unstabilized grades to the carbide precipitation temperature range. Stress-relieving is accomplished by heating to 1,500—1,650F and holding the temperature one hour for every inch of thickness, with a minimum of two hours. The assembly is then cooled uniformly in air.

Economics and Summary

The economics of stainless steel piping are necessarily complex, depending on many diversified factors. The important point is that much hinges on a few critical decisions. These decisions should not be made hastily, but should receive careful and thorough consideration, taking into account all available facts and data. As a guide, the most important factors affecting a proposed stainless piping system are summarized.

Type of Stainless—The first cost of stainless steel piping is high in relation to carbon steel. In piping for the type services under discussion, freedom from corrosion and product contamination are the chief justifications for the use of stainless. The choice of which stainless type must be governed by these considerations with due regard to the fabrication facilities available. The question resolves itself to stabilized or non-stabilized grades or their substitutes and to the variations in alloying elements within these two categories. It should be noted that just as it is uneconomical to select a stainless type inadequate for the service intended, so is it uneconomical to choose a type whose superior, and more expensive, properties are unneeded.

Piping Standards—Pipe conforming to the established iron pipe sizes should be specified. By using pipe having IPS outside diameters as contrasted to nominal O.D. tubing, substantial economies can be effected because standard piping accessories can be used, thus avoiding the expensive special valves, fittings, hangers, jigs, fixtures, and covering required by O.D. tubing.

Pipe Wall Thickness—The minimum wall thickness consistent with good piping design should be used because of the resultant substantial savings. For most corrosion service applications, the new Schedule 10 S recently adopted by the American Standards Association will provide the ideal solution.

Type of Joint—Butt-welded joints should be used to the maximum possible extent. Fittings should be of the butt-weld type, and where joints must be broken, butt-welded flanged joints should be specified.

Welding Considerations — Whenever possible, the inert-arc process should be used to weld stainless piping. Cleanliness before and after welding is of paramount importance. A piping contractor should be chosen who is thoroughly familiar with the problems and complexities of welding stainless steel. He should have the proper facilities and should understand that the success and dependability of the finished job will rest in great measure on the quality of the welding.

The Role of Climatology in Air Conditioning Design

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Climate, as a measurable factor in building design, receives the combined attention of both climatologists and building technologists. In an effort to bring about better understanding of mutual problems, the Building Research Advisory Board of the National Research Council sponsored a January conference of representatives of the two groups in Washington. Mr. Everetts' paper, major text of which follows, analyzed for the conference the manner in which certain factors in heating and air conditioning design are influenced by weather and outlined the most useful types of climatological data.

AIR conditioning is the control of climate, and, particularly in dealing with the comfort of human beings, has developed criteria equal in refinement to those of medicine, electronics and physics. During the past twenty-five years, physiological research has shown that the optimum conditions of human comfort center around an effective temperature of 67½F. This corresponds to a temperature of 76F with a relative humidity of 50%. Higher temperatures with correspondingly lower relative humidities and vice versa may be used for the same effective temperature; however, for the purpose of this discussion, the 76F, 50% R.H. condition will be used as the condition which will provide the minimum of discomfort.

Having estab'ished a condition to maintain, the next step is to quantitatively evaluate the sources of heat to be removed by the air conditioning system in order to properly design a system to meet the requirements. There are five major sources of heat and moisture which are common to all types of structures: (1) Heat transmission, a function of dry bulb temperature only; (2) solar radiation, a function of the intensity of sunshine, surface exposed to the sun and orientation of the structure; (3) lights; (4) people; (5) ventilation air, a function of both dry bulb and dewpoint temperatures; hence, a direct function of wet bulb temperature.

There is a sixth classification of heat gain sources which are peculiar to individual applications. These sources are heat from small motor operated machines, such as tabulators; heat and moisture from food, such as in a restaurant; and heat and moisture from materials being processed in a manufacturing plant.

Typical Structures

In order to evaluate the importance of weather data in air conditioning design, it is necessary to make a comparison of different types of applications. For the purpose of this discussion, three typical structures will be considered: (1) a private residence; (2) an office building; and (3) a theatre. For further comparison, three different cities have been selected because of their widely divergent weather design conditions: (1) Chicago; (2) St. Louis; and (3) New Orleans. The fact that these cities are all in the Mississippi Valley is purely coincidental. Philadelphia, Memphis,

Photo Credits: Above left, A. M. Byers Co.; above right, Carrier Corp.

and Houston could be used with equal design results.

Table 1 shows the weather design data for June to September, inclusive, for these three cities.

TABLE 1—DESIGN TEMPERATURES

City	Dry Bulb	Wet Bulb	Dewpoint*
Chicago, Illinois	95	75	70
St. Louis, Missouri	100	77	73
New Orleans, Louisiana	90	80	78

*Note: The design dewpoint temperatures shown are not coincidental with the dry bulb and wet bulb temperatures indicated.

The design dry bulb temperature is selected on the basis of the temperature which is not exceeded more than 2½% of the time during the four summer months. The wet bulb and dewpoint temperatures shown are not exceeded more than 5% of the time. These percentage selections are purely arbitrary, based upon years of experience. Any method of selection based upon rational analysis will be welcomed by the industry.

Solar Load

Table 2 shows the heat received from the sun in Btu per square foot per hour on vertical walled buildings at sea level and corrected for atmospheric absorption.

TABLE 2—SOLAR RADIATION ON VERTICAL WALLS IN SUMMER AT 35° N. LATITUDE*

Sun Time	Wall Facing			
	North	South	East	West
	Btu per (hr) (sq ft)			
6	20	0	75	0
7	30	0	190	0
8	10	0	210	0
9	0	25	190	0
10	0	55	145	0
11	0	75	75	0
12 Noon	0	80	0	0
1 P. M.	0	75	0	75
2	0	55	0	140
3	0	25	0	190
4	5	0	0	220
5	30	0	0	190
6	20	0	0	75

*Note: Data prepared by I. M. Levitt of Franklin Institute, and Charles S. Leopold, Consulting Engineer, Philadelphia, Pennsylvania.

Solar radiation load is calculated only for the exposure with the greatest area combined with the solar intensity. For example, a large southern glass exposure will show a greater heat load than a smaller area facing west. With walls of high heat lag the solar radiation is a small part of the total load, whereas, light wall construction will show an appreciable heat gain. Solar load calculations for walls may be made from sol-air temperatures as developed by Professor Mackey or by applying an additional temperature correction to the dry bulb temperature difference.

Cooling load calculations for the residence, office building and theatre, based upon the above design conditions, are shown in Table 3 for the three selected cities.

Residence

Analysis of this table shows some rather interesting and startling facts regarding the value of accurate weather data. The residence used as an example is a 30,000 cu ft, 8-room home with insulated walls and roof, and with venetian blinds. The location is in a typical suburb of a large city.

The cooling load analysis shows that in Chicago the dry bulb temperature alone accounts for 48.4% of the total load, the sun effect for 18.7%, and the wet bulb temperatures 26.6%. In other words, 93.7% of the total load is due to the weather conditions. In St. Louis, the effect of the dry bulb temperature is increased to 52.3% of the total load due to the higher design temperature; the solar radiation drops to 14.5% and the ventilation load increases to 27.6%. In New Orleans the transmission drops to 38.3%; the solar radiation drops to 13.4% but the ventilation load is increased to 41.6%, or 50% greater than in Chicago for the same structure. It is interesting, also, to note that the cooling load chargeable to the weather is over 93% of the total load for a residence with only a variation of 1.1% for the three cities. However, in spite of the high ventilation for New Orleans, the total load for New Orleans is 18% less than for St. Louis.

Cooling Load Factors

From the cooling load analysis it is not difficult to see that the type of building construction, orientation, insulation, shading, attic ventilation, and location of a residence can materially affect the size of an air conditioning plant required to maintain a given condition of comfort. The potential reduction in total load for a residence in New Orleans, while appreciable, is lower than that which could be accomplished in either St. Louis or Chicago.

Another important factor, especially where dry bulb temperature and sun effect are so important, is the storage capacity of the structure. For example, in St. Louis or Chicago, where the daily variation in dry bulb temperature is high compared to New Orleans, the type of structure and its storage capacity for heat makes a great difference in the actual load penetrating the building and the total operating costs. A heavy masonry or concrete structure will have a greater heat capacity than a building of frame construction and consequently will react more slowly to short durations of high temperatures, especially when the night temperatures fall below that to be maintained within the structure. Certain types of construction have actually shown a cooling load due to transmission and sun effect of only 50% of the calculated load figured by the standard conventional methods.

This brings up another factor which is not included in the typical load calculation; that is, a heat lag fac-

TABLE 3—COOLING LOAD ANALYSIS OF THREE BUILDINGS FOR THREE CITIES

Load	Residence						Office Building						Theatre					
	M Btu Per Hr			% of Total Due to Weather			M Btu Per Hr			% of Total Due to Weather			M Btu Per Hr			% of Total Due to Weather		
	C[1]	SL[2]	NO[3]	C	SL	NO	C	SL	NO	C	SL	NO	C	SL	NO	C	SL	NO
Transmission	38.6	48.2	29.0	48.4	52.3	38.3	380	475	285	5.8	6.7	3.8	84	105	63	4.3	5.0	2.7
Solar	15.0	13.3	10.2	18.7	14.5	13.4	400	370	340	6.1	5.2	4.4	120	126	132	6.2	6.0	5.7
Lights and People	5.1	5.1	5.1	0	0	0	3,095	3,095	3,095	0	0	0	875	875	875	0	0	0
Ventilation	21.3	24.5	31.5	26.6	27.6	41.6	2,660	3,160	3,840	40.7	44.5	51.0	850	1,010	1,260	44.1	47.4	54.0
Total	80.0	92.0	75.8	93.7	94.4	93.3	6,535	7,100	7,560	52.6	56.4	59.2	1,929	2,116	2,330	54.6	58.4	62.4

[1,2,3]C = Chicago; SL = St. Louis; NO = New Orleans.

tor in terms of a design daily temperature variation. Such a factor is not available at the present time because of insufficient data on daily variations of temperature. Such information will be of value to correct some of the inconsistencies in air conditioning design for structures with a high percentage of transmission and solar radiation load.

Office Building

The analysis of the cooling load for an office building shows an entirely different picture from a residence. The building taken as an example is a ten-story structure covering approximately 25,000 sq ft of ground area. The load produced by the weather is only 52.6% of the total load in Chicago, of which 40.7% is due to ventilation, and only 5.8% for transmission and 6.1% for solar radiation. St. Louis shows a total load due to weather of 56.4%, of which 44.5% is for ventilation and only 11.9% due to transmission and solar radiation. In New Orleans 51% out of 59.2% of weather load is due to ventilation. It should be noted that over 40% of the total load in all three cases is caused by lights and people in about a 45 to 65% ratio. This is a constant internal load in which the weather plays no part. If this building were twice the height and half the ground area, the load analysis would show an increase in transmission and sun effect of about 10% and a corresponding decrease in percentage of load from lights and people. The ventilation load would remain about the same percentage as it is based upon infiltration and ventilation air for occupants.

Storage Effect

Storage effect also plays an important part in both design and operation of air conditioning for office buildings. As most office buildings are of heavy construction, the effect of temperature and sun (except on glass surfaces) is greatly reduced. As the calculated load is small to begin with, it can readily be seen that temperature and sun load are of minor importance compared to the wet bulb temperature (ventilation) which accounts for 40.7% of the total load in Chicago to 51% of the total calculated heat load in New Orleans.

Theatres

Theatres, again, show a different picture than either residences or office buildings. People and ventilation make up 87% to 90% of the total load, while only 8.4% in New Orleans and 11% in St. Louis is due to dry bulb temperature and sun. The load from lights is insignificant and can be neglected. In the case of theatres, the wet bulb temperature is the all-important factor and should be studied with care. There is no storage factor or lag in wet bulb effect on the air conditioning load; therefore, no compromise can be taken as with dry bulb temperature or solar radiation.

Heating Load

An analysis of the heating load shows an entirely different picture from the cooling load, primarily because of the antithesis of their nature. Lights, people, and solar radiation play no part in the design of a heating system because heating is required during the absence of these heat producing sources. The entire heating load is based upon transmission and ventilation; however, the ventilation load in winter is predicated upon dry bulb temperature because of the low moisture content of winter air.

Design temperatures for heating are based upon lowest average, lowest mean and combinations involving lowest recorded temperatures. Wind effect, which is also important in heating design, is included in heat transfer factors (15-mile wind velocity) as well as a wind factor either in terms of an additional temperature difference or as a percentage of the transmission load. In addition, a 10% to 15% factor of safety is added to the total calculated load. There are many cases of record where an air conditioning system cannot meet the design requirements on days of extreme temperature and humidity conditions in the summer, but I have yet to see, after twenty-six years of experience, a heating system that does not have ample capacity if it is designed according to the conventional method of calculating the heating load.

No account is taken of the fact that low temperature periods occur in the early hours of the morning

when it makes little difference whether the temperature in the heated space drops five or ten degrees below that required. Also, during periods of low temperature the wind movement is at a minimum, thus reducing the rate of heat flow through the structure below that calculated. This means that most heating systems are over-designed, resulting in extra first cost, overheating and wasteful consumption of fuel.

Heat storage in a building structure is seldom considered, although it plays an important part in leveling off wide fluctuations in outside temperature. There are many cases of record where, during winter storms, the heating system has been out of service for twenty-four hours or more and the inside temperature of the structure has dropped only 10 to 15 degrees with outside temperatures in the neighborhood of zero, whereas calculations tend to prove quite a different picture.

Heat Lag

Although temperature is the governing factor in heating design it should be used with due caution and consideration for heat lag, period of time heating is required (daytime for office buildings, day and evening for residences, twenty-four hours for hospitals and institutions, etc.), prevailing winds and wind protection and whether a warm air, convection, or panel heating system is to be used.

An analysis of the heating load shows that for a residence, 79% of the load is due to heat transmission and 21% due to ventilation. There is little that can be done about reducing ventilation load as this particular residence is equipped with weatherstripping and storm sash. The transmission could be reduced by wind protection, orientation to sun, sealing up leaks in the attic space and many other small but little thought of items.

The heating load for an office building and theatre is predominantly ventilation, accounting for over 83% of the total load. Ventilation must be provided while the buildings are occupied; however, as soon as the occupants are out of the building, the ventilation can be shut down, thus reducing the heating load to only that required for transmission.

Operating Costs

The design of any heating or air conditioning system must consider operating costs which are also proportional to the weather. In this case, however, design temperatures or maximum or minimum conditions are of little importance. The number of hours at which dry and wet bulb temperatures exist, accumulative intensity of solar radiation, period of time and intensity of occupancy, lights and requirements of ventilation—all enter into the total hours of operation.

If, for example, the fresh air intake of an air conditioning system is designed to take the full dehumidifier capacity, advantage can be taken of outside wet bulb temperatures below the design wet bulb to reduce the refrigeration load and to reduce the number of hours the refrigeration system will operate. If the fresh air intake is only sized to take the minimum fresh air required for ventilation, then the refrigeration will have to operate many more hours to take care of the internal loads, which are appreciable in office buildings and theatres. If we assume a full size fresh air intake, the load factor can readily be determined for the four summer months from data published in "Summer Weather Data," by J. C. Albright and the writer, and published by the Marley Company of Kansas City.

With reference to these data, it is interesting to note that Chicago has 35.6% of the total hours over 76F, while St. Louis has 53% and New Orleans 76%, even though St. Louis has the highest design dry bulb temperature of the three cities. The same data for the wet bulb temperature show that Chicago has 53% of the total hours in excess of 63.5F W. B. (76F D. B. and 50% R. H.), St. Louis 74% and New Orleans 98%.

Relating these figures to Table 3, a relative load factor for the four summer months can be established for the three structures and the three cities as shown in Table 4.

TABLE 4—RELATIVE LOAD FACTOR
(New Orleans = 100%)

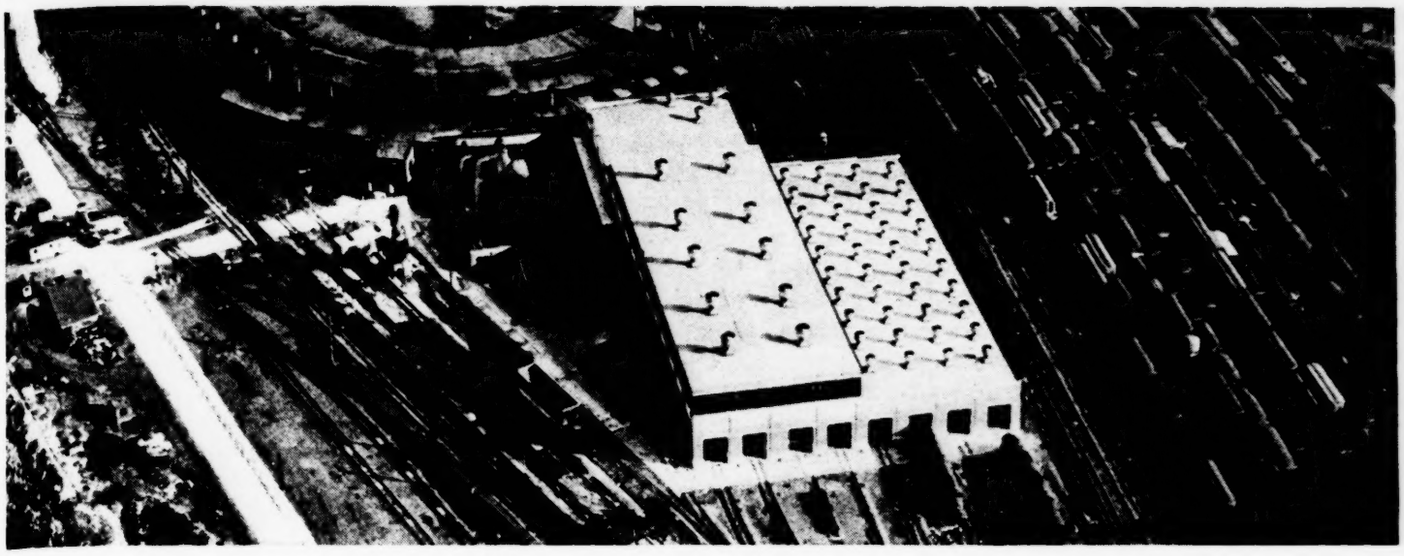
City	Residence	Office Building	Theatre
	Load Factor, Percent		
Chicago	62.1	78.2	77.4
St. Louis	79.9	87.3	87.1
New Orleans	100.0	100.0	100.0

From Table 4 it can be seen that a residence in Chicago, for the four summer months, would have an operating cost of only 62.1% of a residence in New Orleans, assuming utility rates to be equal. It should also be noted that an office building and theatre do not show as great a reduction because of the greater internal load and lower effect of the weather on the total load.

Unfortunately, detailed weather data are not available for spring, fall, and winter, so no comparison can be made for these seasons. These data are vitally important to determine operating hours and costs as they involve forecasting of public utility loads, total operating costs which are chargeable against capital investment of a system, length of season for operation of air conditioning and heating systems and the basic design of such systems.

Such data are not only of value to commercial and residential air conditioning and heating but are of equal importance in dehumidification for the storage of materials and low humidity manufacturing; humidifying in textile mills, tobacco factories and flour mills; accurate design and control of both temperature and humidity in many manufacturing plants; and numerous other purposes other than the treatment of air.

The correlation of weather data is of such importance today that it should rate a high priority among those whose interest it will serve.



Heating a Locomotive Repair Shop

A UNIQUE heating plant, embodying three different types of systems, is used for two new Pennsylvania Railroad Diesel locomotive repair and maintenance shops, one at Harrisburg and the other at Enola, Pennsylvania. Designed primarily for comfort of employees working in the huge structures, the arrangement in each makes use of radiant heating, unit heaters and blast heaters.

Heating locomotive repair shops always has been recognized by railroad men as a difficult problem because of the tremendous size of the structures and the large doors that are frequently opened. Moreover, bringing tons of cold steel in the form of locomotives into such buildings also chills the indoor air.

The Harrisburg shop is designed for repairing and servicing of passenger train Diesel locomotives, while the Enola shop, across the Susquehanna River from Harrisburg, is for Diesel freight locomotives. Both structures are of virtually the same design, so a description of one fits the other.

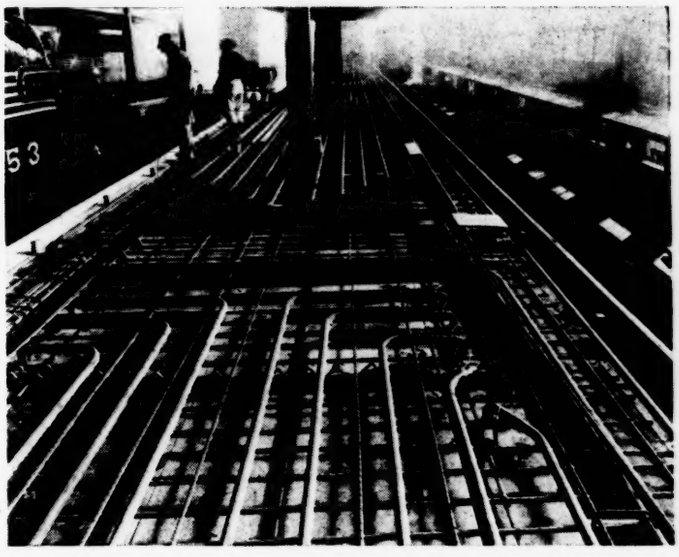
A rectangular-shaped steel-frame building, the main section of the Harrisburg shop is 200 ft by 268 ft. There is an adjoining structure 102 ft long by 97 ft wide at the north end, containing a machine shop, offices and other departments.

Heat losses in the brick-walled main structure with its large steel-sash windows, were calculated by standard methods to be approximately 15,850,500 Btu per hr with design temperatures 60F indoors and 0F outdoors. Maximum roof height of the main section is 56 ft.

There are eight 14 ft by 18 ft rolling steel doors in the west wall of the building to admit locomotives. Six sets of tracks rest on steel columns in the shop. Four of them, on the south side, extend entirely through the building to exit doors. The others terminate inside at the extreme east end where the machine shop addition joins the main building.

Raised reinforced concrete platforms 7 ft 2 inches above the working floor level run the length of the building between the sets of tracks. Each platform is 14 ft wide. Embedded in the 6-inch concrete floor slab of each platform are wrought iron radiant heating pipes spaced on 10-in. centers. All coil piping is 1¼-inch diameter.

With a mean operating water temperature of 140F, the platform radiant heating coils are designed for an output of 85 Btu per (hr) (sq ft) upwards and 61 Btu per (hr) (sq ft) downwards. This output is calculated to establish an air temperature of 60F with the slab temperature being not more than 85F. Water for the coils is provided by a heat exchanger using steam at 125 lb per sq in. from the yard's power plant. Pumps and heat exchanger are in the basement of the adjoining building. About 13,750 gph of water are circulated through the radiant heating coils. Radiant heating coils in two grid circuits also are employed throughout the machine shop and offices as the comfort-producing medium.



Radiant heating coils in platforms between tracks.

Eighteen blast heaters are positioned in side wall openings of the main building just above ground level but below platform level. These are designed to temper fresh air brought in from the outside to replace fouled air vented from the structure. Each heater has a design output capacity of 800,000 Btu per hr.

Supplementing the radiant heating system and the blast heaters are 31 overhead (about 15 ft) steam-fed unit heaters ranging in capacity from 140,000 to 700,000 Btu per hr, each. Six of the largest, with 1½-hp motors, are located to cover the locomotive doorways and are controlled by separate thermostats to operate when the air temperature drops below 50F as cold air enters through door openings. All unit heaters also have manual controls so their fans can be operated for air circulation without heat.

Of the three systems, the radiant heating coils are the first to operate. When the outdoor temperature drops below 35F, the blast heaters go into action mainly to prevent the water in them from freezing. If the demand in the building cannot be met by the radiant system and the blast heaters, the unit heaters are started. In general, however, the unit heaters are used more frequently to provide the blanket of warm air at the doorways.

During last winter, although temperatures were mild, the radiant heating system alone took care of most of the comfort conditions in the building. Maintenance engineers at the shop estimated that 90% of the heat in the building last winter was produced by the radiant system, although previous calculations show this system is designed only to supply less than half the total requirements.

Workmen at the shop expressed satisfaction with the comfort provided by the radiant system. The warm platform floors, they said, kept them comfortable. Radiant heat emanating from the platforms also helped to melt ice and snow from the locomotives and speeded up evaporation of residual water.

To remove fumes and stale air from the building, 50 electric roof ventilators with a total capacity of 643,000 cfm are used. Ten 48-inch ventilators, each with a capacity of 19,900 cfm, are installed over the heavy repair section and the remaining 40 ventilators, each 36 inches with a capacity of 11,100 cfm, are over the other sections.

The sanding, fueling, watering, and washing station platform is located outdoors and is 40 ft wide, 457 ft long. Complete service can be given locomotives as they move past the station on two sets of tracks flush with the platform surface. Six fueling points about 30 to 35 ft apart consist of two water lines, two fuel oil lines and one fire-foam line each. The platform pipes are vertical and oil and water are delivered to locomotives through hose lines with trigger-type nozzles. Four-inch and six-inch wrought iron pipes run from five 67,000-gallon fuel oil storage tanks to the fueling locations. Wrought iron pipes 2½-in. in diameter are used for the oil and water lines leading from the mains to the dispensing hoses.

Sprayed Coating Seals Warehouses for Fumigation

A new application of the Vinylite plastic coating which protects military and naval equipment against weather and rust makes possible a drastic cut in the cost of sealing crop storage places for insect fumigation. U. S. Department of Agriculture experts developed this new use of Vinylite resin-base coatings in an effort to reduce the annual loss of millions of dollars worth of tobacco.

New generations of destructive insects emerge two to four times in a seven-month season each year. Tobacco warehouses must be fumigated at the height of emergence of these insects for maximum effectiveness. Speed of application and easy maintenance are therefore important qualities in sealing materials.

This plastic coating can be sprayed on a warehouse rapidly and with a minimum of untrained labor. Applied with a pressure spray-gun, the Vinylite resin-based solution dries in a tough film that is resistant to weather, flame, and chemicals. A coating only five-thousandths of an inch thick prevents fumigant gas escaping from the warehouse, yet is not affected chemically by the fumigant.

The sealer can be sprayed on the outside of the storage place, or on the inside if precautions are taken to draw off fumes of the rapidly evaporating solvents, which are flammable. Many areas, such as unbroken tile walls and closed fire doors, need be sealed only at the edges with plastic coating, whereas conventional paper and mineral asphalt sealers would require that the entire area be covered.

Holes larger than one-quarter inch receive special sealing treatment. An adhesive binder is first sprayed around the hole, then a special webbing solution is sprayed over the hole until a filmy web has been built up. This is then covered with the plastic coating for a continuous seal. Breaks larger than 18 inches can be sealed in the same manner after being segmented with pieces of tape. Still larger openings are closed with cheesecloth or paper which serves as a base for the plastic coating.

The Vinylite plastic retains its elasticity and does not dry up or break off like conventional sealers. However, it can be easily stripped away, except where binder has first been applied.

Maintenance of the plastic seal is sometimes complicated for the first few months by curious visitors and laborers who pinch, punch, and even dig pieces out of the plastic film with pocketknives. However, the Agriculture Department experts believe it requires less care than conventional sealers because elasticity and tensile strength enable the plastic film to wear well under most adverse conditions. The coating is easily patched; additional coats adhere to the original film and are not unsightly.

Court Decisions of Interest to the Heating Industry

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A review of court rulings in new lawsuits relating to the heating field. Important points of law are presented and references given to the cases discussed.

RECENTLY a reader wrote, as follows: "We sold and installed certain heating equipment and the property owner gave us a promissory note as full payment. When the note came due he refused to pay the amount due claiming our agent misrepresented the capacity and efficiency of the equipment. We are told that the property owner cannot introduce before the court any testimony as to a verbal guarantee made by our salesman since no guarantee is mentioned in the note. Is this so?"

The answer is: It is not so. This property owner may refuse to pay the note if he proves that the salesman made a verbal guarantee or other agreement which the seller ultimately breached.

For illustration, in A. E. Speer, Inc. v. McCorvey, 49 S. E. (2d) 677, it was shown that a purchaser gave his promissory note as payment for heating equipment. Later the purchaser refused to pay the note on the grounds that the agent who sold the equipment for which note was executed for the purchase price had promised to take the equipment back, with no obligation upon the purchaser to pay, if the equipment failed to satisfy the purchaser.

The higher court held that the purchaser need not pay for the heating equipment because he proved that it would not heat the building in a satisfactory manner. The court said:

"A warranty, express or implied, is an incident to the sale of any chattel unless expressly waived . . . A negotiable instrument given for purchase money does not purport to be the actual contract. The obligation of the vendor rests in parol, and parol evidence to prove the terms of such a contract are always admissible."

Therefore, it is quite apparent that a note is not an absolute contract. In other words, the purchaser may introduce any testimony which proves that the seller violated his agreement on which the note is founded, and the court will declare the note void.

Patent Refused

Modern higher courts consistently hold that an inventor can obtain a valid patent only for a distinctively new and novel invention.

For example, in Application of Lloyd, 172 Fed. (2d) 583, an inventor filed an application for a United States patent for an insulation material having an insulation temperature range up to and in excess of 1,000F; a high modulus of rupture; and unaffected by immersion in water. The material comprised calcium silicate, bentonite, and asbestos fibers.

The United States Court of Customs and Patent Appeals refused to issue a patent on the ground that it was not a new invention in view of old patent Nos. 1,666,936, and 1,932,971.

Readers may obtain copies of these patents by addressing the Hon. Commissioner of Patents, Washington, D. C. and remitting 25 cents for each copy.

Jury Must Decide

Considerable discussion has arisen from time to time over the legal question: Where a buyer and seller disagree over the contents of a verbal contract, who must decide their legal rights? The answer is: Only a jury will decide whose testimony is truthful.

For example, in Lepore v. Fuscellaro, 57 Atl. (2d) 442, legal controversy developed over payment for a jig for boring holes in castings for oil burners. The manufacturer of the jig contended that there was no guarantee as to the boring speed, whereas the purchaser contended that the manufacturer promised orally to deliver a jig which would speed up production by doing faster work than the old jig was capable of doing.

The higher court refused to decide the case, saying:

"Did the defendant (purchaser) simply order a jig that was capable of boring castings for oil burners or did he order a jig that would not only do that work but also do it faster than the jig he was using? . . . Whether or not there was such an agreement was a question for the jury."

Hence, if the jury believes the manufacturer's testimony, the purchaser must pay for the jig. If, on the other hand, the jury believes the purchaser's testimony, the purchaser need not pay for the jig.

Sales Tax Law

Considerable discussion has arisen from time to time over the legal question: Are articles, merchandise, and materials used in processing exempt from state sales taxation? The answer is no.

For example, in Phillips & Buttorff Mfg. Co. v. Carson, 217 S. W. (2d) 1, a state law was litigated which exempts from sales tax all materials for processing, or conversion into articles of tangible personality for resale where such materials become a component part of the finished product. This question was presented the court: Is coal and fuel oil exempt from taxation when used for generation of steam with

which to operate power generators for purpose of manufacturing articles for wholesale and retail sale?

The higher court refused to exempt coal and oil from state sales taxation.

Also, this court held that fire-brick bought for use to line furnaces, and clay to line ladles, utilized to transfer molten metal from iron furnaces into molds, are not exempt from the retail sales tax.

Bad Faith

Recently a higher court held that a property owner need not pay the balance due on air conditioning equipment where the testimony proved that, in order to make the equipment function according to the guarantee, the contractor placed one thermometer on the floor and another outside where there was no free circulation of air.

For example, in Super-Cold Southwest Co. v. First Baptist Church of Corsicana, 219 S. W. (2d) 569, the testimony showed facts, as follows: The Super-Cold Southwest Co., as contractor, and the First Baptist Church entered into a contract whereby the contractor was to install air conditioning equipment in the church for the sum of $8,500. Of this amount, $1,500 was paid in cash at the time the contract was signed. The contract contained a clause to the effect that the air conditioning equipment "will lower the temperature within the main auditorium and maintain such temperature during 11 a. m. and 12 noon at a level which runs during such period, at least 15 degrees lower in said main auditorium than the running temperature in the shade outside of the church building proper during such period." When making the test, the contractor placed one thermometer on floor of church, and another on the outside in a location where it would not receive free circulation of air.

The higher court refused to order the church to pay the balance due the contractor, and said:

"We are of the opinion the outside thermometer, located as it was, reflected a spirit of bad faith upon the part of the appellant, and that the test was unfair to the appellee and constituted fraud upon the part of appellant. We are of the opinion that the equipment supplied by the appellant (contractor) is mechanically incapable of reducing the temperature 15 degrees within a reasonable time, as provided by the contract."

Property Owner Liable for Breach

According to a recent higher court, a property owner is legally bound to fulfill the exact terms of a contract involving installation of heating or air conditioning equipment although such terms are unusual and extraordinary.

For example, in Paszamant & Co. v. Gian Bar, 66 Atl. (2d) 180, the testimony showed facts, as follows: Paszamant & Co., as contractor, agreed to install air conditioning in a bar and restaurant owned by the Gian Bar. The contract contained a provision that a 7.5 hp motor would be installed which "can be exchanged for a 5 hp single phase motor when available." In other words, a 5 hp motor was proper capacity but the contractor could not obtain it immediately and the 7.5 hp motor was installed as a temporary substitute.

The contractor installed the air conditioning equipment and demanded the balance of the contract price which the Gian Bar refused to pay. Then the contractor sued to recover the balance due. The higher court ordered the Gian Bar to pay the balance due and stated that the contractor could install the 5 hp motor when it was available. The court said:

"The defendant (Gian Bar) first breached his agreement by failing to pay the cash balance when due. He continued this breach after the 5 hp motor became available by refusing to pay the balance theretofore due until after the exchange of motors. He had no right to impose this condition."

Not Within Scope

According to a recent higher court if an employe injures an innocent person while acting outside the scope of his employment, the employe is personally liable and the employer is relieved from all liability.

For example, in Gurklies v. General Air Conditioning Corp., 205 Pac. (2d) 749, an employe was authorized by his employer to carry tools in his automobile at all times so that the employe would be ready to respond to heating and air conditioning service calls. One night the employe had a serious accident when making a trip in the automobile for his own pleasure and not on a service call for his employer. A pedestrian was seriously injured and he sued the employer for damages claiming that the driving of the automobile at the time of the accident, with the tools, was in furtherance of the employer's business.

The higher court refused to agree with this contention and explained that the employe himself was personally liable to the pedestrian and the employer was not liable. The court said:

"It is undisputed that at the time of the accident the employe had completed his day's work, had paid a social visit to the home of his foreman, and was on his way to his own home. While the safekeeping of the tools was a benefit to the employer and in furtherance of the employer's business, the operation of the vehicle upon the highway at the time of the accident was wholly without the scope of the employment."

Dust is Dangerous

According to a recent higher court, owners of apartment buildings must notify workmen of known dangers.

For example, in Willis, 174 Pac. (2d) 688, the testimony showed facts, as follows: A floor contractor sanded hardwood floors.

Later, the fine dust was thrown into a furnace The dust exploded, seriously burning the workman. The higher court awarded the injured workman $12,500 damages.

Independent Contractor

Considerable discussion has arisen from time to time over the legal question: When is a heating contractor an independent contractor? The answer to this ques-

tion is important because a property owner need not pay unemployment nor workmen's compensation on independent contractors.

According to a recent higher court a person is an independent heating contractor if he works not under the direction of anyone, and if he comes on a job when he desires to do so, except that he must finish the job within a specified period of time.

See Plencner v. Wautoma, 24 N. W. (2d) 669.

Property Owner Solely Liable

Considerable discussion has arisen from time to time over the legal question: If a property owner hires a heating contractor to do work, who is liable for injuries negligently caused ordinary citizens?

The answer is: Generally speaking, where a property owner employs an independent contractor to do a job, the property owner is not liable for the negligence of the contractor. However, if the property owner fails to obtain a permit from the city, required by law, the property owner and not the contractor is liable.

For example, in Barrabee v. Crescenta, 198 Pac. (2d) 558, it was shown that a property owner hired a contractor to do certain work. The contractor dug a trench in the street for installation of pipe. The property owner did not receive a permit from the city, as was required by a state law. The contractor failed to put barricades or other warnings at nighttime to warn automobile drivers of the danger. That night an automobile owner ran into the ditch. There were no lights or barriers at the ditch.

The court held the property owner solely liable and also laid down this important legal rule: An independent contractor is not liable for his negligence in failing to place warning signs at an open ditch if the property owner is prohibited by a state statute from excavating in a public street without a permit and the property owner in violation of this law gives a contract to a contractor to do the work.

The court explained that if a property owner obtains a lawful and valid permit, the contractor is solely liable for injuries caused by his own negligence.

House Burns Down

It is well established law that a heating contractor may be held personally responsible to a property owner who sustains financial losses due to the contractor's negligence.

For illustration, in Kuhr v. Frizzelle, 40 S. E. (2d) 405, a property owner sued a heating contractor and proved that the latter had contracted to install in the basement of his home a hot air furnace, together with the pipes leading from the furnace to the various outlets throughout the house.

The property owner alleged that in making the installation the heating contractor used insulation around the hot air pipes which was not fireproof. Also, the property owner proved that when he built a fire in the furnace the house caught fire. The higher court decided that the fire was due solely to the contractor's negligence in failing to properly insulate the pipes with a fireproof material.

The higher court held that a heating contractor is liable in damages to a property owner who suffers financial loss as a result of the contractor's negligence.

For comparison, see Levine v. Bochiaro, 59 Atl. (2d) 224. Here the testimony showed facts, as follows: One Pecorella owned a factory building in which was a heating system and chattels. There were two boilers. One boiler exploded. The boiler in which the explosion occurred was a steel horizontal fire tube low pressure heating boiler, fired by an oil burner. Both boilers were connected to a common chimney by means of a metal flue pipe connection. The oil burner which was involved in the occurrence had been improperly installed.

Several customers had sent materials, chattels and equipment to the factory to be processed. These items were destroyed, and the owners sued Pecorella for their value. The latter attempted to avoid liability by proving that he employed an experienced heating contractor to maintain and repair parts of the heating system. The higher court refused to hold in favor of Pecorella, and said:

"If it may be assumed that the plaintiffs' loss resulted solely from the failure of Milos (contractor) to make proper repairs to the oil burner, defendant (Pecorella) nevertheless is liable."

Contractor Breached Contract

According to a recent higher court, a contractor who breaches a contract is liable for all damages resulting from his breach.

For example, in Gore v. Sindelar, 74 N. E. (2d) 414, a contractor sued a factory owner to recover the balance due on a contract for installation of a furnace. The factory owner filed a counter suit for damages alleging that the contractor's failure to install the furnace properly resulted in loss of use of the furnace while it was being repaired.

The higher court awarded the factory owner damages based on $15 a day for the time the factory was not in operation due to defects in the furnace. This court said:

"When a contract to install a furnace is entered into, there is an implied provision in the contract that the work should be done in a workmanlike manner, if there is no provision in the contract to the contrary."

Compensation Not Awarded

According to a recent higher court an employe who voluntarily quits his job cannot receive compensation under the State Unemployment Compensation Act.

For example, in Wagstaff v. Director of Division of Employment Security, 79 N. E. (2d) 3, it was shown that an employe named Wagstaff took a job as oil burner installer's assistant at $1 an hour. Wagstaff felt he should get steamfitter's pay of $1.37½ an hour and asked his employer for this increase of wages. The employer informed Wagstaff that he would have to think it over, which he did and decided that Wagstaff was not worth an additional $15 a week. The following Monday Wagstaff did not appear for work. Wagstaff applied for compensation under the State Unemployment Compensation Act. The higher court refused to award compensation, and said:

"He left his employment voluntarily without good cause."

Lease Obligates Heating Company

Modern higher courts consistently hold that a clause in a lease contract is valid which stipulates that a heating company shall be responsible for damage or destruction of leased property.

For example, in Mirjian v. Ideal Heating Corp., 206 Pac. (2d) 20, the testimony showed: the Ideal Heating Corp. leased certain real property. The lease contract contained a clause that the heating company would hold the landlord harmless from damage resulting from use, misuse, or neglect of the premises. A fire commenced upon the leased premises and spread to the adjoining premises occupied by the landlord, causing extensive destruction and damage to both.

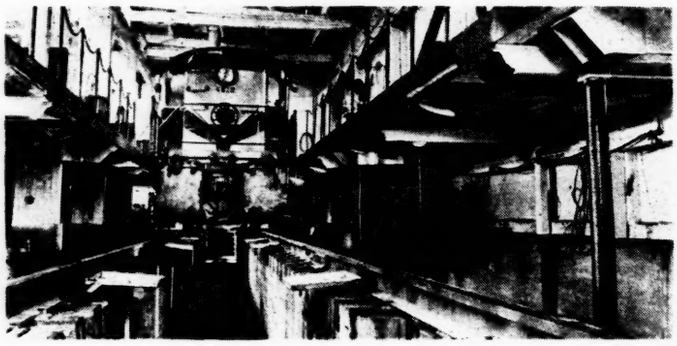
In subsequent litigation the higher court held that such a clause in a lease contract is valid, but held further that the landlord could not attach the tenant's real and personal property to enforce payment.

Readiness to Work

Considerable discussion has arisen from time to time over the legal question: Under what circumstances may an ill employe receive compensation under the State Unemployment Compensation Act? The answer is: When the employe cannot perform his regular work, and cannot obtain employment at work he is able to do.

For example, in Hinkle v. Lannox Furnace Co., 83 N. E. (2d) 903, it was shown that an employe of the Lannox Furnace Co. became ill and was unable to do his regular work. However, while he was able to work and was available for work as a watchman and checker, he was unable to obtain such work. Hence, the higher court held that he was entitled to receive unemployment compensation under the State Unemployment Compensation Act.

Picture Paragraphs



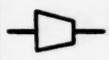
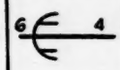
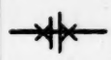
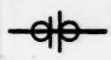
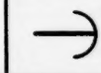
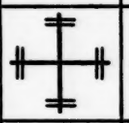
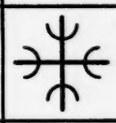
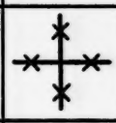
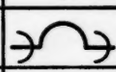
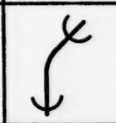
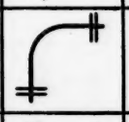
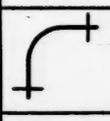
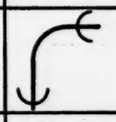
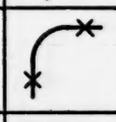
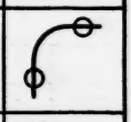
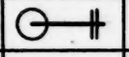
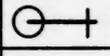
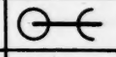
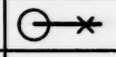
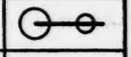
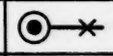
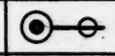
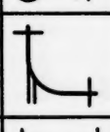
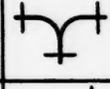
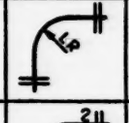
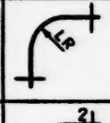
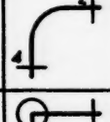
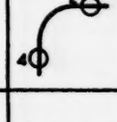
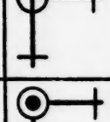
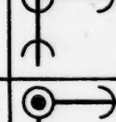
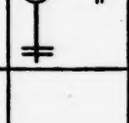
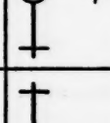
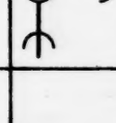
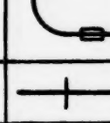
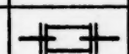
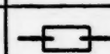
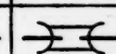
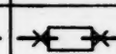
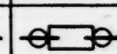
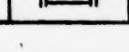
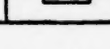
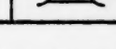
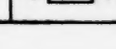
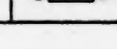
(Above) Warm Feet for the Iron Horse: At the Detroit & Mackinac Railway's diesel locomotive repair and maintenance shops, Tawas City, Michigan, blasts of heated air are discharged on locomotive undercarriages to melt off ice and snow. The air is transported through ductwork from a Dravo Counterflo heater to the repair pit. The same heater also helps maintain comfortable temperatures for employees. A tctal of four oil-fired Dravo heaters are used for the entire repair shop.

(Above) Plant of Auto Specialties Manufacturing Co. near Hartford, Mich., shows three-way appreciation of workers' comfort. The large circular cone assemblies are air diffusers built by Anemostat Corp. of America for draftless air conditioning. The Auditone ceiling manufactured by U. S. Gypsum Co. provides sound-quieting, and fluorescent units furnish an abundant supply of light.

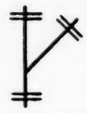
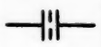
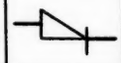
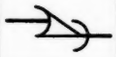
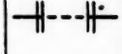
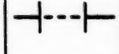
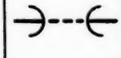
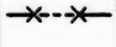
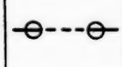
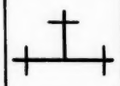
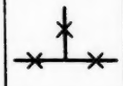
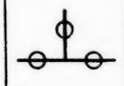
(Left) The newest apartment in the center of New York City's finest residential district, 860 Fifth Avenue, will have a concealed steam heating system of Jones & Laughlin steel pipe. Shown here as the building is under construction, a workman is installing a riser pipe which is part of the system. The building is designed by architect Sylvan Bien. J. J. Secoles, Inc., is builder. The heating system is being installed by Soling Heating & Cooling Co.

AMERICAN STANDARD GRAPHICAL SYMBOLS – PIPE FITTINGS

The accompanying symbols were designated as an American Standard in May, 1949, by the American Standards Association, sponsoring organizations being The American Society of Mechanical Engineers and American Institute of Electrical Engineers.

NAME OF FITTING	FLANGED	SCREWED	BELL & SPIGOT	WELDED	SOLDERED
BUSHING					
CAP					
CROSS, REDUCING					
CROSS, STRAIGHT SIZE					
CROSSOVER					
ELBOW, 45-DEGREE					
ELBOW, 90-DEGREE					
ELBOW, TURNED DOWN					
ELBOW, TURNED UP					
ELBOW, BASE					
ELBOW, DOUBLE BRANCH					
ELBOW, LONG RADIUS					
ELBOW, REDUCING					
ELBOW, SIDE OUTLET (OUTLET DOWN)					
ELBOW, SIDE OUTLET (OUTLET UP)					
ELBOW, STREET					
JOINT, CONNECTING PIPE					
JOINT, EXPANSION					

AMERICAN STANDARD GRAPHICAL SYMBOLS – PIPE FITTINGS

NAME OF FITTING	FLANGED	SCREWED	BELL & SPIGOT	WELDED	SOLDERED
LATERAL					
ORIFICE FLANGE					
REDUCING FLANGE					
PLUG, BULL					
PLUG, PIPE					
REDUCER, CONCENTRIC					
REDUCER, ECCENTRIC					
SLEEVE					
TEE, STRAIGHT SIZE					
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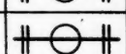
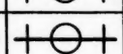
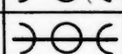
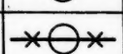
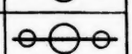
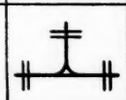
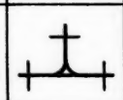
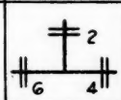
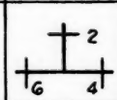
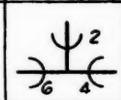
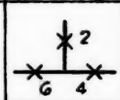
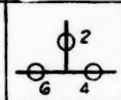
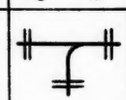
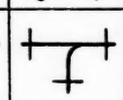
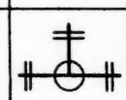
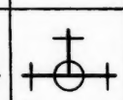
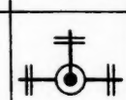
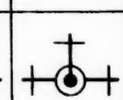
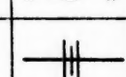
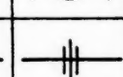
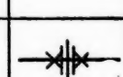
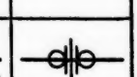
TEE, OUTLET DOWN					
TEE, DOUBLE SWEEP					
TEE, REDUCING					
TEE, SINGLE SWEEP					
TEE, SIDE OUTLET (OUTLET DOWN)					
TEE, SIDE OUTLET (OUTLET UP)					
UNION					
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HEATING AND VENTILATING'S REFERENCE DATA

March, 1950

Experience is my Classroom

By T. W. REYNOLDS

WATER SHORTAGES

It has been an extremely dry season in many localities and especially so in New York City. Furthermore, January's hot weather in this city has called for air conditioning systems to operate out of season in such places as dress shops and other places subject to a high internal heat load. How, then, will the shortage of water affect air conditioning in New York?

New rulings (December 30, 1949) have been issued by the Department of Water Supply and while they are not much different from previous rulings, so far as the quantity of water allowed for air conditioning, they are much more stringent in the method used to check and eliminate any excess use of water. These new rules will be reviewed by the department in May, at which time (with the water recently added to the reservoirs and additions to come if up to average for the same period of other years), it is optimistically anticipated that the emergency will be over. Meanwhile, let us hope for rain and more rain.

Formerly, the water which a consumer could waste without using a water saving device was limited to 5 gpm, while with such a device he could not exceed 15% of the consumption that would normally be used without such device. Now the percentage is reduced to 5% (which is within the range of such devices), the gallons per minute is 2 gpm per ton, while equipment must be under 3 tons capacity.

This leaves us about as before, except that it is easier for authorities to check the equipment tonnage by reading the motor horsepower. Finally, to leave no stone unturned, the water (when not in excess of ½ gpm) must be metered or charged for on an annual rate basis subject to the discretion of the department, and when in excess of ½ gpm *must* be metered. Formerly, metering was in question only where the water consumption exceeded 50 gpm, or the rated capacity of all equipment was 25 tons or more, and then only if the department required it.

A further requirement is that all new or existing air conditioning equipment under 3 tons, not using recirculated water, must be provided with an automatic regulating device to limit the flow of water in relation to the condenser temperature reduction requirements of the apparatus.

By the time this is in print, the emergency may be over. Nevertheless, the foregoing information is of importance as showing the tendency to enforce all rulings by methods which will readily disclose any excess use of water

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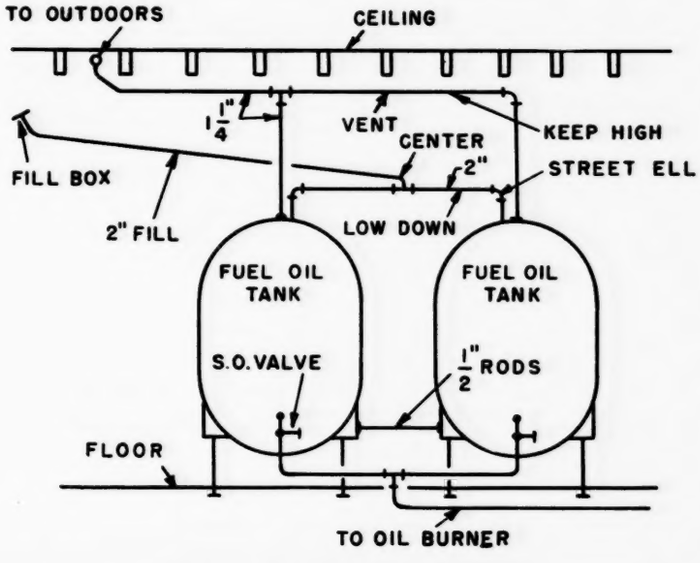
Note: Mr. Reynolds is Chief, Air Conditioning Division, Abbott, Merkt & Co., Engineers, New York.

• OIL TANK PIPING FOR TWO TANKS—Continued

In the November, 1948, issue of HEATING AND VENTILATING, we made some remarks about the proper method of connecting two fuel tanks, now that we are allowed two tanks in New York City. A correspondent from Philadelphia took decided exception to the method, as noted in the July, 1949, issue. Meanwhile, further remarks along the same lines appeared in the issue of February, 1949. Now it is refreshing to find someone who agrees with our earlier comments—Walter Otto of W. Otto Bros. Maintenance Co., Forest Hills, N. Y., who writes, not without a sense of humor, as follows:

"Thanks for your instructive and interesting comments. Don't let that correspondent from the City of Brotherly Love get under your skin. He knows not whereof he speaks.

"When we installed our first job of twinning oil tanks, we, after some thinking, decided that the horizontal fill connection should be made level and as close to the tanks as possible, using for this purpose street ells (see sketch). We also decided that the two vent connections should be brought up separately as high as possible before joining them into one 1¼-inch line at the ceiling or, better still, in the ceiling if possible. We did this even if the balance of the horizontal run had to be run straight or without a rise from there on. The main point is to keep as much elevation as possible between the horizontals of the fill and vent lines.



Method of twinning fuel oil tanks.

"On this and a similar job we tested out the arrangement by letting the oil delivery man shoot in the oil at full speed. The tanks, however, filled evenly and without oil spilling from the vent. The vent alarms seemed to throttle the escaping air so that the oil ran in smooth and even.

"Incidentally, the high-up vent connections should be so piped that one is behind the other. They should not be taken together in the center because the air streams would then clash or oppose one another. Also note in the sketch that the two slow opening valves to the oil burner should be always open and that the ½-inch rods keep the two tanks from spreading. In some places someone is always piling heavy articles in the space between the tanks, thus tending to force the piping connections apart."

• LOOK TO THE THERMOSTAT

A certain thermostat for heating control in a tenant's quarters of a large apartment house was found with ice bags deliberately appended thereto, making it hot for everyone.

A certain thermostat for heating control in a tenant's quarters of another large apartment was found with a 200-watt bridge lamp thoughtlessly placed adjacent thereto, making it cold for everyone else but the players, who, between the drinks, excitement and local heat, were warm enough.

So it is often a better method to use an outdoor thermostat, although in any building where there is a high internal heat load it is not so good for control of cooling.

• COOL RETURNS

Usually, most everyone imbued with the spirit of conservation will do all they can to keep condensate as hot as possible, yet there is nothing so beneficial to a vacuum pump as arranging the heating returns to come back as cold as possible. By so doing, both heat recovery and pump efficiency are achieved. A coil in a tank (Fig. 1) to cool the hot returns and transfer the flash heat to a domestic hot water generator will answer the purpose, although the more simple or cheaper method of just leaving the returns bare is sometimes sufficient.

Money will be spent for covering returns when their small size and extent and low temperature would, if bare, provide usable heat to the structure and at the same time cool the pump. One often sees the most expensive grade of covering used just to save 50 Btu, a quantity of heat of no consequence compared to 1,000 Btu recoverable by a coil from the latent heat of condensate re-evaporation. Consider, further, that when we do cover a pipe, we render it more conspicuous by its lighter color and greater size. We also increase the maintenance, obstruct lighting, and provide more top surface for the lodgment of dust.

Even where pump discharge is wasted to the sewer, it is still desirable to reduce hot water temperatures and eliminate flash steam. The resulting increase in pump efficiency allows full vacuum to be obtained, gives a better operation of the heating system, and eliminates possible trouble in any sewer handling the hot water.

A good illustration of one of the benefits to be obtained by the use of a cooling coil may be exemplified by referring to a certain recording gauge on a steam line to the coil of a hot water generator. In this case, the installation of a cooling coil eliminated the erratic circle on the chart. This circle was formerly interrupted by jagged sawteeth lightning effects due to the intermittent operation of the steam supply valve. So put a cooling coil (Fig. 1) in the returns going to the hot water generator to smooth out the curve on the chart, but call the cooling coil a heating coil if you wish, for the coil is both cooling and heating. The coil is desirable for many reasons, for a job gets no younger, some traps leak soon, other later, and in the colder weather there is more condensate, therefore more flash at the high peaks of quantity and temperature.

The coil should be submerged to prevent the passage of steam to the pump and to avoid other troubles. Air so trapped, must then be by-passed overhead to the pump inlet as shown in Fig. 1. More than one thermostatic trap is provided so as to furnish sufficient trap capacity to take care of the air being removed from the system, the exact number depending upon the air capacity of the vacuum pump. These traps should not be less than ¾ inch in size.

The use of thermostatic traps in the vent by-pass around the coil heater is vital to the effectiveness of the coil. Should steam be present after circulation is established, the traps will close and the vacuum will then pull condensate, steam and air through the heater, condensing the steam and thus preventing it from entering the pump receiver. Obviously, the points of steam leakage into the vacuum return should then be located and such troubles overcome in so far as practical. It should be remembered, however, that while steam is not supposed to be present in a vacuum return, it is going to be to a greater or less extent after a few years of system use.

The air by-pass should be uncovered and not less than 4 ft in length. Headers at each end will be necessary if there are several returns coming back. Point *A* should be higher than *B* to avoid a lift at *B* and pocketing of steam by water between *A* and *B*. The vent from the vacuum pump can be discharged to the boiler room if the pump is small, otherwise it should relieve to outdoors. There should be no valve on the vent. Put one on and someone will close it.

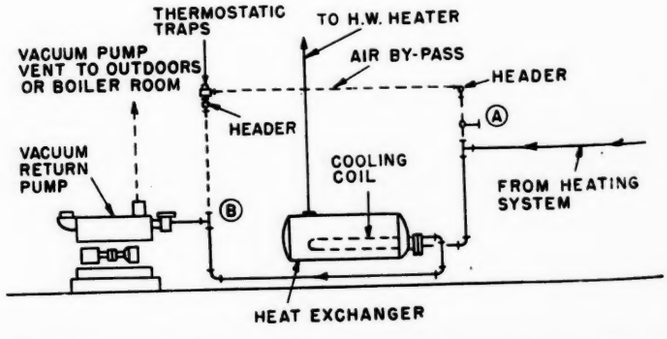
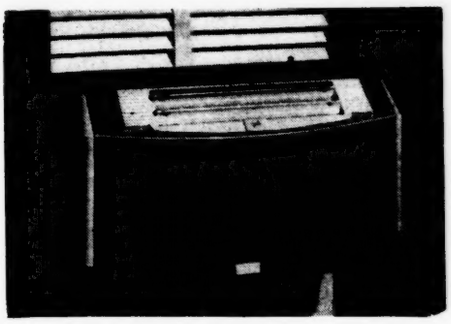


Fig. 1. Cooling the return water to save heat and the pump.

NEWS OF EQUIPMENT AND MATERIALS

York Room Cooler

NAME—York room air conditioner.
PURPOSE—Room cooling.
FEATURES—Design of this window-sill unit permits minimum depth in-

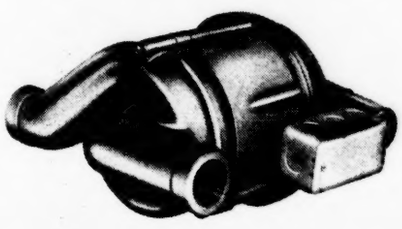


side the window. Cooling maze coil of staggered-tube and corrugated-fin design is said to extract the maximum amount of moisture from the air to provide a cool dry climate. A seven-ply replaceable filter frees the air of dirt and impurities. Finger-tip controls permit the introduction of outside air at any time, with or without cooling, and makes possible an improved atmosphere even when cooling is not required. A pump-out control quickly removes stale air caused by excessive smoking in the conditioned space. Cabinet insulation and rubber mounted mechanism reduces the operating sound to a minimum. Hermetically sealed cooling systems are said to be tamper-proof and trouble-free.
SIZES AND CAPACITIES — Available in ½- and ¾-hp units, and in several color finishes to harmonize with interior decorative scheme.
MADE BY—*York Corporation, York, Pa.*

Item 81

Empo Circulator

NAME—Empo circulator pump.
PURPOSE—Circulator for forced circulation, radiant heating systems, and for use as a coolant pump for evaporative coolers, machine tools and production processes.



FEATURES—Motor is built to withstand hard usage; to accelerate to full speed in a few seconds; and to operate with no radio interference. It is available for use with standard voltages and frequencies. Capacitor can be removed without dismantling motor, and connections are made in junction box mounted on motor. All parts are said to be readily accessible. Rotating parts are carried on one shaft supported by oversize bearings. Careful dynamic balancing is said to assure vibrationless and silent operation.
SIZES AND CAPACITIES—Capacity at free flow, 40 gpm or 20 gpm at 10-ft head. Available in all standard voltages and frequencies.
MADE BY—*The Piqua Machine & Mfg. Co., Piqua, Ohio.*

Item 82

Petro Industrial Burner

NAME—Petro industrial oil burner, model W-A-E.

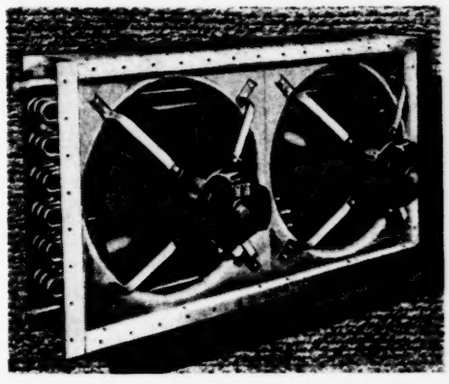
PURPOSE—Burner to handle No. 5 fuel oil.
FEATURES — Burner provides efficient combustion of No. 5 oil that requires a moderate amount of preheating, that is, a No. 5 oil with a viscosity ranging from 300 SSU at 100F to 40 seconds Saybolt Furol at 122F. Identical in every respect with the model W burner designed for cold No. 5 oil, this unit has a thermostatically-controlled electric heater or tempering element which is factory mounted and is an integral part of the burner. Unit is available in belt-driven or built-in motor types to meet all electrical characteristics for capacities up to 100 gph. It can be supplied for fully automatic, semi-automatic or manual operation and for fixed, compound or modulated system of firing.
MADE BY—*Petroleum Heat & Power Co., Stamford, Conn.*

Item 83

Kramer Condenser

NAME—Unicon.
PURPOSE—Air-cooled condenser developed for commercial refrigeration and air conditioning installations.
FEATURES—This self-contained remote type air-cooled condenser consists of a coil, housing, motor and fan. Unit may be advantageously placed near a window, wall opening, or other well ventilated space within reasonable distance from the compressor. It can be provided with a protective hood for the motors for outside mounting. Unit uses individual fans and motors so that the full capacity of the compressor can be used for refrigeration. Unit can also be used in conjunction with an air- or water-cooled condenser; in such installations the water-cooled condenser would cut in on high pressure.
SIZES AND CAPACITIES — Six sizes from ¾- to 5½-ton capacity.
LITERATURE AVAILABLE — Bulletin No. U177.
MADE BY — *Kramer Trenton Co., Trenton, N. J.*

Item 84



Chrysler Dehumidifier

NAME — Chrysler Airtemp dehumidifier.

PURPOSE—Hermetically sealed unit for dehumidification for use in homes and offices.

FEATURES — Untreated air is drawn over the cooling coils by a fan so that whatever moisture is present in the air is condensed and retained in a removable collecting receptacle. Aluminum finned tubing is used for the evaporator and condenser coils to minimize odors and to prevent corrosion. The 1/5 hp reciprocating type compressor is completely sealed. Moving parts are partially submerged in oil and all bearing surfaces are pressure lubricated. Although a large water collector or container is provided, unit can be permanently connected to a drainpipe or placed over a floor drain. Compressor operates on standard 115-volt, 60-cycle current.

SIZES AND CAPACITIES—For removing excessive humidity in enclosed spaces up to 13,500 cu ft. Unit is 34 inches high, 16 inches wide at the bottom and 13 inches wide at the top.

MADE BY—*Airtemp Div., Chrysler Corp., Dayton, Ohio.*

Item 85

Hoffman Condensation Pump

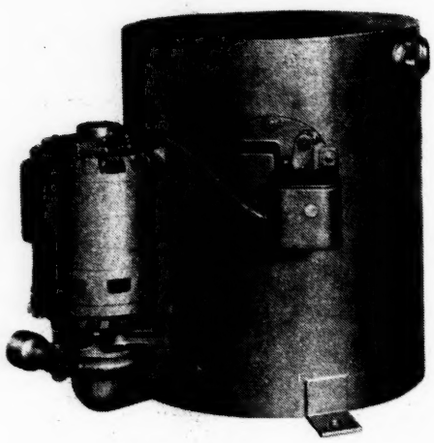
NAME—Hoffman economy condensation pump, type M-R.

PURPOSE—Condensation pump for low pressure steam heating system.

FEATURES—The pump has a one-piece cast bronze impeller rigidly fixed on a stainless steel shaft. A bronze wearing ring is provided for the cast iron pump casing. Bearings are pre-lubricated. Pump head and motor mounting is a single piece casting, machined to assure permanent alignment between pump and motor. The 1/3 hp motor operates at 3,450 rpm. A 2-pole, heavy duty float switch is used. Adjustment of the float rod stops, fits the unit to condensate loads up to 6,000 sq ft EDR. The receiver is constructed of heavy welded steel. Entire motor and impeller assembly can be lifted by removing three bolts without disconnecting any piping.

SIZES AND CAPACITIES—Up to 6,000 sq ft EDR. Receiver capacity is 15 gal.

LITERATURE AVAILABLE — Bulletin No. CP-949.



MADE BY—*Hoffman Specialty Co., 1001 York St., Indianapolis 7, Ind.*

Item 86

Magna-Sight Flow Gage

NAME—Magna-Sight flow gage.

PURPOSE—A simple low-cost flow rate indicator for coolants, opaque liquids, slurries and other fluids.

FEATURES—Unit consists of a short body with flanged or screwed pipe connections to accommodate a fixed orifice in the lower end. A tapered metering plug rises and falls with fluid flow rate in accordance with variable area metering principles. Metering plug carries a permanent magnet and a hollow, cylindrical soft-iron follower that rides in an external slot. Covering the slot is a plate on which is engraved a calibrated scale. The position of the follower relative to the scale indicates the flow rate. Gage is available in brass, bronze, iron, steel, and type 316 stainless steel and can be used for temperatures up to 400F and pressures up to 500 lb per sq in.

SIZES AND CAPACITIES—Sizes from ¾ to 4 inches, with maximum capacities from 3.5 to 250 gpm.

LITERATURE AVAILABLE—Catalog 96.

MADE BY—*Fischer & Porter Co., 96 County Line Rd., Hatboro, Pa.*

Item 87

Equatemp Valve

NAME — Equatemp bronze balancing valve.

PURPOSE—Balancing valve for hot water radiant heating systems.

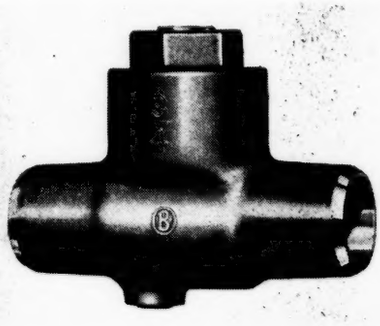
FEATURES—Valve is said to provide both positive leak-tight shut-off and adjustable flow in a single valve. Closing and balancing actions are provided by a butterfly type disc which is fitted with a composition rubber O ring to assure a positive leak-tight shut-off for bleeding or venting of lines. The straight-through design of the oversize port permits optimum flow through the valve and is said to eliminate turbulence. Valve is designed to accommodate any of several standard venting attachments. A well is drilled into the stem to provide a method for taking temperature readings.

SIZES AND CAPACITIES — Available with solder-type ends in sizes ⅜ to ¾ inch or with screwed ends in sizes from ¾ to 1½ inches.

LITERATURE AVAILABLE—Folder.

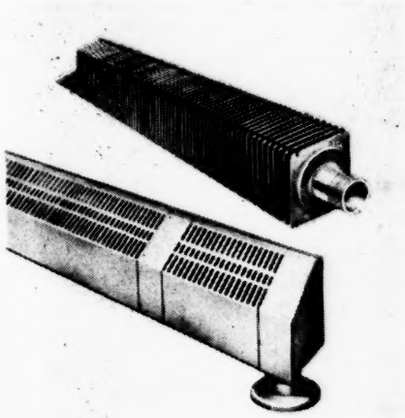
MADE BY—*Ohio Brass Co., Mansfield, Ohio.*

Item 88



Kritzer Coils

NAME—Kritzer commercial fin-pipe coils.
PURPOSE — Space heating through the use of extended surface pipe or coils.

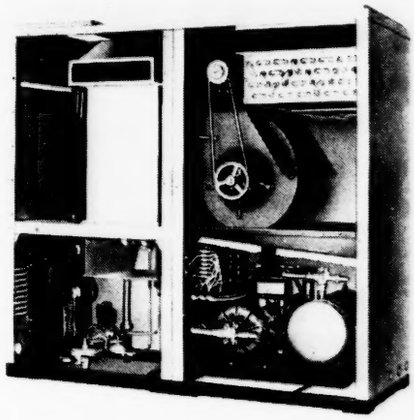


FEATURES—Coils are furnished in sections for various applications. They are made from steel pipe, tested for high working pressure, and protected from cracking under sudden shock. Pipe is chamfered for welding or is supplied threaded. The steel fin is made with a specially designed flexible collar to promote heat transfer and has a mechanical grip to provide resilience for forced fitting. Coils are supplied with a gray prime coat or, on order, a galvanized coating. Available for unit are an expanded metal guard and a sloping baseboard cover to house the coil.
SIZES AND CAPACITIES — Available in three sizes in lengths from 2 to 20 ft. Steel 2-inch pipe with steel fins has a heating surface of 6 sq ft per lineal foot; steel pipe 1¼ inch with fins has a heating surface of 5¼ sq ft; 1¼ inch copper tube with copper fins has 4¼ inch sq ft of heating surface per foot.
LITERATURE AVAILABLE—Bulletin.
MADE BY—*Kritzer Radiant Coils, 2901 W. Lawrence Ave., Chicago, Ill.*

Item 89

Bryant Air Conditioner

NAME—Bryant all-weather conditioner, Model 576.
PURPOSE — Combined heating and cooling unit for year-round use.
FEATURES — The heating section contains a high stage, low stage and reheat burners. When the two-stage thermostat has both contacts closed, all burners operate at full gas input. When air leaving the unit reaches the setting of the furnace fan switch, fan starts operating and the maximum heating capacity is supplied. When full heating is satisfied, the low stage is left in operation. During mild weather this low stage may be sufficient to maintain comfortable conditions. Fan motor and belt adjustment provide for quiet operation and for ease in changing fan speed. Bryant gas pressure regulator and high and low stage gas valves are used. Burners are cast iron with raised drilled port. A thermostat and a humidistat contained in a one-room control controls summer operation. If either the thermostat or humidistat is not satisfied, the refrigeration system operates. If

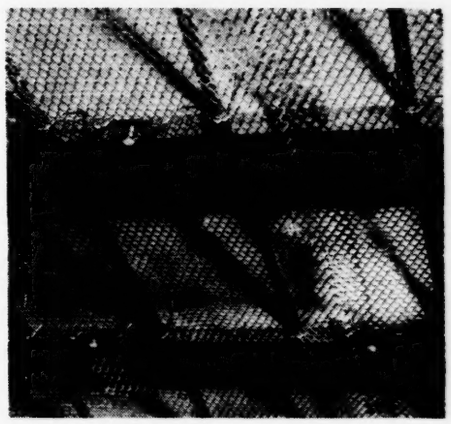


the thermostat is satisfied, but the humidistat is not, the refrigeration system continues operating lowering the air temperature to condense additional moisture. However, during this operation, a small burner in the heating section is called into service to temper the cooled dried air. Unit is shipped in two sections, each completely factory assembled. The refrigeration system uses Freon-12.
SIZES AND CAPACITIES — Available in two sizes—3-ton cooling capacity combined with a heating input up to 150,000 Btu per hr, and a 1½-ton cooling capacity combined with a heating input up to 100,000 Btu per hr.
LITERATURE AVAILABLE — Bulletin.
MADE BY — *Bryant Heater Div., Affiliated Gas Equipment, Inc., 17825 St. Clair Ave., Cleveland 10, Ohio.*

Item 90

Copper Tube Hangers

NAME—Kynex tube hangers.
PURPOSE — For supporting tubing in radiant heating installations.



FEATURES—Supports tubes tightly against the underside of joists, accurately spaces rows of tubes and keeps them in alignment, saves coil installation time, holds standard metal lath in a level plane and saves plaster and plastering time. Accommodates various sizes of tubes on 4-inch and 6-inch centers. Standard 1½-inch large-head roofing nails are used to secure the lath. Suitable for any joist size and spacing.
MADE BY—*The Kynex Company, 21 West St., New York 6, N. Y.*

Item 91

Alfol Insulation

NAME—Alfol asbestos insulation.
PURPOSE—Insulating material for sheet metal ducts and steam pipes.
FEATURES—Asbestos wrap is made of sheet or corrugated asbestos firmly bonded to a sheet of aluminum foil that is said to reflect 95% of radiant heat. The sheets are fitted to pipes or ducts with a slight overlap and are secured by standard insulation bands.
MADE BY—*Alfol Division, Reflectal Corp., 155 East 44th St., New York, N. Y.*

Item 92

Ceramic Valve

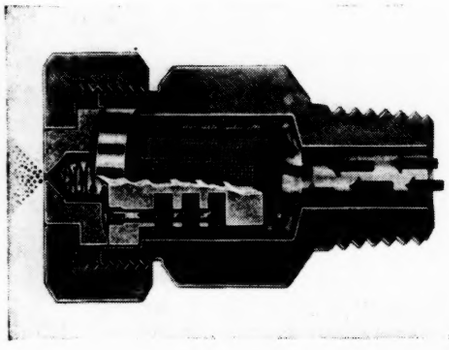
NAME—Merit ceramic valve.
PURPOSE — Valve designed for applications involving highly corrosive conditions and for extreme temperatures.

FEATURES—Body is made of a ceramic suitable for continuous 300 lb per square inch pressure at temperatures up to 2,000F to control the flow of highly corrosive gases or chemicals with the exception of hydrofluoric acid and hot alkali concentrate. Valve body is machined from a solid slug of this ceramic prior to final firing and has a hardness 0.9 that of diamonds. Valve stem is also fabricated from this ceramic and has alternate hard and soft Teflon packing rings as seals. Stainless steel studs can be mounted in the valve body if desired.
SIZES AND CAPACITIES — Available in sizes of ½, ¾, 1, 1½, 2, and 3 inches.
MADE BY — *Emmett Machine & Manufacturing, Inc., 2249 Fourteenth St., S.W., Akron 4, Ohio.*

Item 93

Binks Atomizing Nozzles

NAME—Binks atomizing nozzle, No. 12 Series.
PURPOSE—Nozzle to provide atomization of fluids.
FEATURES—Nozzle, which is constructed of bronze unless otherwise specified, is also available in steel, stainless steel, monel metal, or any other machinable metal obtainable in bar stock. Nozzle is made in standard ¼ inch and ⅜ inch pipe connection sizes with either male or female bodies. It consists of four parts which are interchangeable in male and female units of the same size. Capacity and spray characteristics are determined by the fluid pressure and size of orifice in the tip. Easily cleaned strainers are provided for small capacity nozzles only, as design makes it unnecessary to use strainers in the larger sizes.

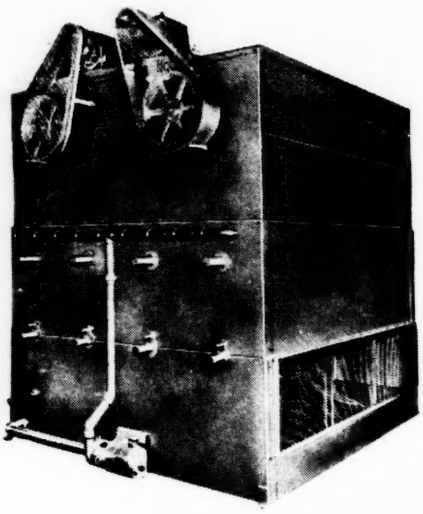


LITERATURE AVAILABLE—Bulletin.
MADE BY — *Binks Manufacturing Co., 3114 Carroll Ave., Chicago 12, Ill.*

Item 94

BAC Evaporative Condenser

NAME—BAC evaporative condenser, Model UL.
PURPOSE—Outdoor type evaporative condenser.
FEATURES—Unit has a direct driven fan, and, although manufactured as a single unit, is shipped in two sections to facilitate installation. Coil section is normally divided into four equal circuits. However, it is possible to arrange the coil to provide separate circuits of any specified capacity so that the condenser may be connected to several compressors operating several systems. Condenser is of heavy steel construction; coil and pan of steel hot-dipped galvanized after fabrication. Fan section employs four centrifugal blowers which are operated by two independent fan motors. Spray nozzles are operated by a single close-coupled centrifugal pump. Large access doors provide easy accessibility for maintenance. Eliminators can be removed by taking off the access doors that are small enough for one man to handle.



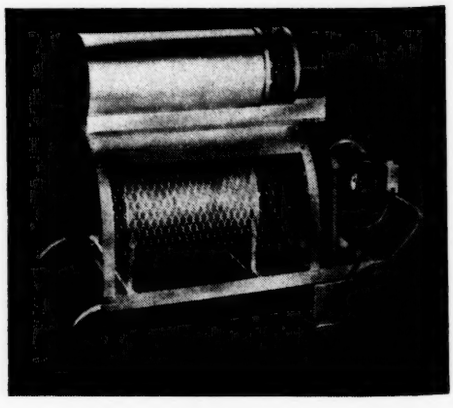
SIZES AND CAPACITIES — Available in 14 different capacities starting with 105 tons refrigeration and extending to 210 tons refrigeration based on a Freon rating of 105F condensing temperature, 40F suction temperature, and 78F wet bulb.
MADE BY—*Baltimore Aircoil Company, Inc., 715 W. Pratt St., Baltimore 1, Md.*

Item 95

Silent-Glow Heater

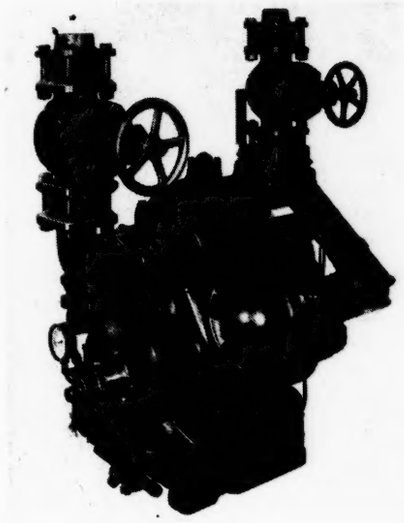
NAME—Silent-Glow portable heater, Model RF.
PURPOSE—Portable unit for temporary heating to meet commercial and industrial needs.
FEATURES—A Silent-Glow gun-type pressure atomizing oil burner is used which burns No. 2 or lighter grade oil. Unit has a built-in 5-gallon capacity fuel tank. Combustion chamber is made of special alloy stainless steel. The all-steel body is electrically welded and is mounted on rubber tired wheels. All moving parts and heated surfaces are fully protected. A 10-inch auxiliary fan operated by a ⅛ hp motor delivers 1,200 cfm.
SIZES AND CAPACITIES — Output, 168,000 Btu per hr; length, 53 inches; width, 29 inches; height, 39 inches.
MADE BY—*The Silent-Glow Oil Burner Corp., 850 Windsor St., Hartford 5, Conn.*

Item 96



York Ammonia Compressor

NAME—York V/W compressor.
PURPOSE—Multi-cylinder compressor, direct drive, for use with ammonia refrigerant.

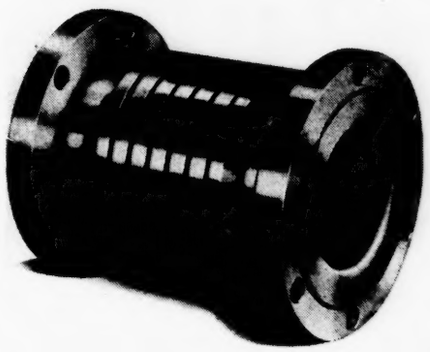


FEATURES—Arrangement of cylinders, which are similar to airplane engine designs, results, it is said, in freedom from vibration. Precision built ring plate type suction and discharge valves and spacious gas ports and gas passages all contribute to quiet performance. Aluminum alloy connecting-rods are used with reinforced crankpin ends. All bearing surfaces are lubricated by an oil pump geared to the crankshaft. High pressure relief valves comply with safety code requirements. Compressor is available with a rugged structural base complete with motor rails and belt guard or with soleplate for mounting on concrete foundation. A packless shaft seal with double diaphragm under continuous oil head minimizes refrigerant and friction losses. Automatic control of capacity reducers can be furnished on order. Compressor has 8 cylinders, each measuring 6¾ x 5 inches.
MADE BY—*York Corp., York, Pa.*

Item 97

Flexoniflex Joint

NAME—Flexoniflex high pressure expansion joint.
PURPOSE—Joint to control axial, offset and radial motion in high pressure piping systems.
FEATURES—Unit consists of corrugated, bellows-type sections of stainless steel or other alloys formed within integral control rings and end sections. Rings of this unit are not bolted in place but have intimate relationship with the pressure carrier. Joints are manufactured with single or multiple plies and may be lined or unlined, depending on application. Units are designed to provide a suitable safety factor as required by the service. Maximum motion depends upon pressures involved for the specific applications and the frequency of that motion. Units for absorbing radial and offset motion, as well as axial motion, are engineered from this basic unit design.
SIZES AND CAPACITIES — From ⅝-inch I.D. through the range of extra high pressure pipe sizes, and

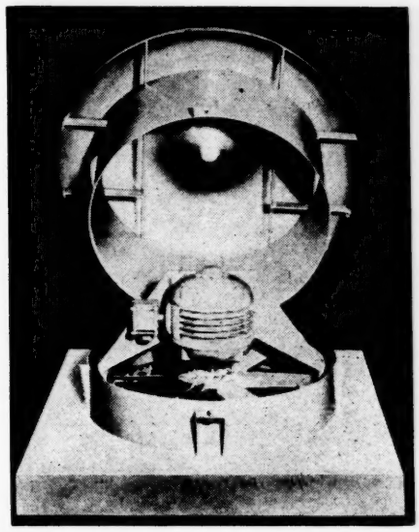


with a temperature range from sub-zero to 1,400F for stainless steel.
MADE BY — *Chicago Metal Hose Corp., Maywood, Ill.*

Item 98

Axial-Flo Roof Ventilator

NAME—Axial-Flo roof exhauster.
PURPOSE—For use with industrial and commercial ventilation systems.
FEATURES—Complete unit is low, streamlined and modern in appearance, with welded heavy steel plate construction for added durability. The hinged cover of the motor driven fan in a weatherproof housing permits easy access for inspection, maintenance and lubrication. A mushroom type diffuser head permits an uninterrupted flow of discharge air. The wheel is of the axial airfoil propeller type, built of cast aluminum alloy with adjustable pitch blades.
SIZES AND CAPACITIES—Blade diameter from 14 to 48 inches and air



delivery from 1,000 to 40,000 cfm; static pressure up to 1 inch.
MADE BY—*Chicago Blower Corp., 4558 W. Congress St., Chicago 24.*

Item 99

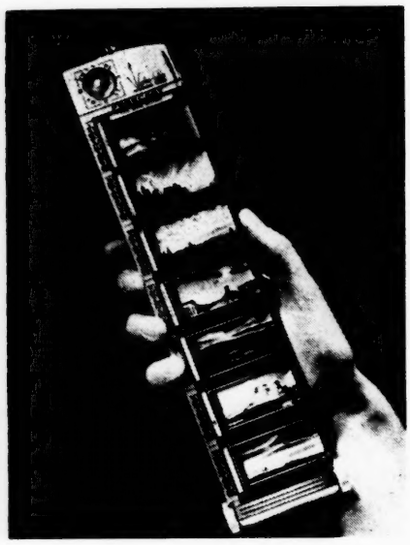
Infra Insulation

NAME—Infra insulation, Type 6.
PURPOSE — An aluminum thermal insulation with 6 reflective surfaces for installation under ceilings, between beams and over or under radiant heating panels.
FEATURES — Insulation consists of three tough permanently separated metal sheets and two fiber partitions that are flame, mold, vermin-proof to form an insulation layer with 6 full reflective spaces that can be installed with one operation. Insulation provides 6 reflective surfaces of an emissivity and absorption of only 3%. The 3 aluminum sheets are spaced only 1¼ inches apart. The material has two outer reflective spaces and four inner rows of alternating reverse triangular reflective spaces created by the fiber partitions. Permeability to water vapor is said to be zero. Material will not separate nor store condensation or moisture.
LITERATURE AVAILABLE — Bulletin on simplified physics of thermal insulation.
MADE BY—*Infra Insulation, Inc., 10 Murray St., New York, N. Y.*

Item 100

Weather Forecaster

NAME—Aeroil Weather Guide.
PURPOSE—For forecasting weather on the spot to enable contractors

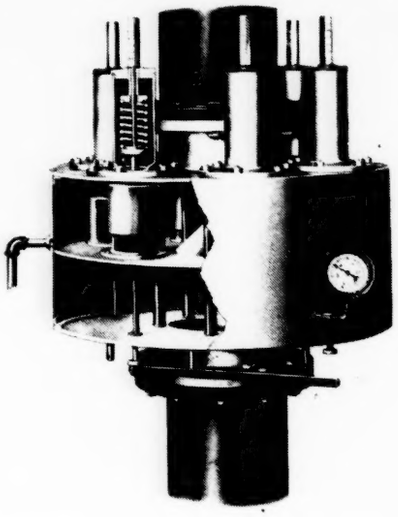


properly to dispose their working crews, and for similar uses.
FEATURES—Pocket size device developed by Dr. Irving P. Krick, nationally known meteorologist, contains a variety of skies illustrated in color. To use, device is set to face North so that wind direction can be determined, existing sky matched with the nearest one on the device, a wheel is turned, and the weather prediction appears.
SIZES AND CAPACITIES — Available in seven models, depending on the section of the U. S. in which it is to be used as follows: North Eastern, Great Lakes, South Eastern. North Central, South Central, North Western, South Western.
MADE BY—*Aeroil Products Company, Inc., Wesley Street, South Hackensack, N. J.*

Item 101

Klipfel Valve

NAME—Klipfel back pressure and relief valve.
PURPOSE—To maintain steam pressure at any point between zero and 20 lb per sq in. for installation in heating systems, process application, and power plants.
FEATURES—Inner valve consists of an inverted cup which slides on a piston that is cast integrally with the valve seat. Inlet pressure enters the chamber between the cup and piston through a restricted opening in the center of the piston. The narrow seating edge of the cup eliminates nearly all the venturi effect of high velocity steam. Regulation of inlet pressure from closed to full-open is accomplished by a spring with small increments of pressure holding only one valve at a time in a throttling position. Repair or replacement of one of the units does not prevent operation of the valve as a whole. The welded, all steel construction of the valve body provides a strong unit with minimum of weight.

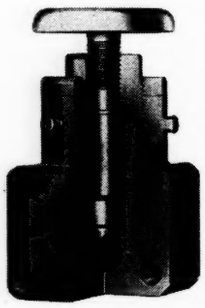


MADE BY — *Klipfel Valves, Inc., Division of Hamilton-Thomas Corp., Hamilton, Ohio.*

Item 102

Karbate Globe Valve

NAME—Karbate impervious graphite globe valve.
PURPOSE—Valve for shut-off and throttling service for use in systems conveying corrosive fluids that are free from abrasive solids.
FEATURES—Except for the Teflon packing, all the valve parts that are in contact with the fluid are of impervious graphite to prevent corrosion and contamination, and to reduce maintenance expenses.

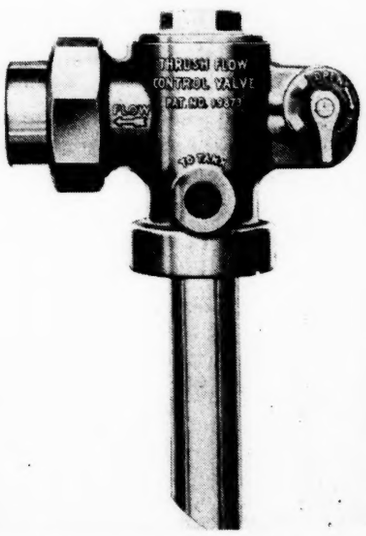


Graphite is said to provide resistance to practically all corrosive chemicals and is resistant to thermal shock. The tapered disc valve seat provides accurate and close control of fluid flow and is self-reseating. Valve has short face-to-face dimensions and is self-lubricating.
SIZES AND CAPACITIES — Available in 1- and 2-inch sizes.
LITERATURE AVAILABLE — Catalog section M-8803A.
MADE BY — *National Carbon Div., Union Carbide and Carbon Corp., 30 E. 42nd St., New York 17, N. Y.*

Item 103

Thrush Flow Control Valve

NAME—Thrush flow control valve with air vent tube.
PURPOSE—Valve for use on automatically fired forced circulating hot water heating systems to vent air as fast as it accumulates in the top of the boiler and to pass this air directly into the pressure tank.
FEATURES—Water going to the heating system is taken from the boiler several inches below the outlet opening and free of air. The valve is said to increase heating efficiency by positive air elimination from the boiler, and to make unnecessary the frequent venting of radiators or convectors. Air is

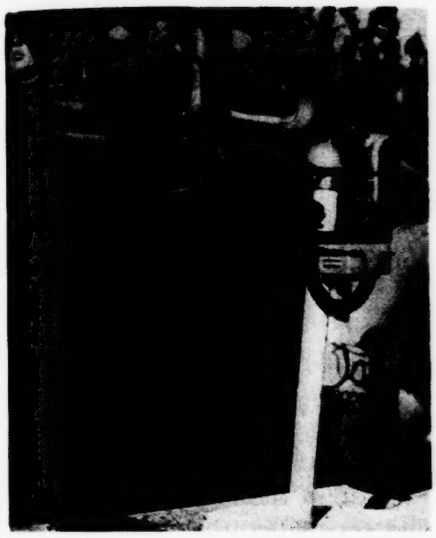


placed in a pressure tank where it can serve a useful purpose.
SIZES AND CAPACITIES — Available in five sizes from 1 to 2½ inches.
MADE BY — *H. A. Thrush & Co., Peru, Ind.*

Item 104

In-Car Heaters

NAME—National in-car heaters.
PURPOSE—Portable heating device to heat automobiles in drive-in theaters.



FEATURES—Unit is designed to work off 220-volt lines instead of 110, to reduce the possibility that theater patrons may steal unit in the hope that it could be converted for home use. An Alliance shaded pole, induction motor is used, designed for quiet operation. Jacketed 3-conductor cable is used which stretches to 10 ft. A cast aluminum, squirrel-cage type fan has been designed to transmit maximum heat without interfering with speaker performance. A tubular type weatherproofed sheathed steel heating element is used. Unit has been approved by the Underwriters' Laboratories. Weight is 2½ lb.
MADE BY—*National Heaters, Inc., 1647 Victory Blvd., Glendale 1, Calif.*

Item 105

Gas Winter Air Conditioner

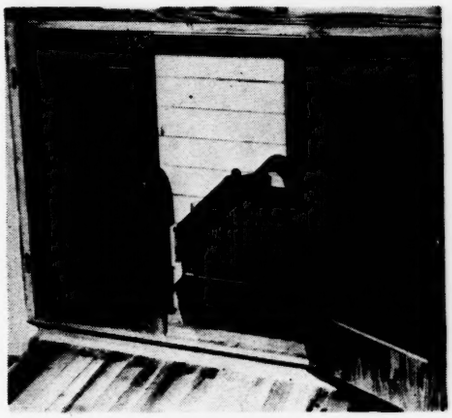
NAME—Gas economy SG series winter air conditioner.
PURPOSE—For forced warm air heating, particularly where there is a minimum of floor space and head room. May be used as either first-floor Hi-Boy or basement installation.
FEATURES—Heating elements are 12- or 14-gage steel arc welded. Burner head, of drilled port type, is made of cast iron. Gas control and piping assembly easily removed for servicing by disconnecting one union and two pipe straps. Filter may be removed for cleaning or replacing simply by sliding out. Return air may be brought in on either side. Casing of green baked enamel on 20-gage steel. Unit will operate on gravity in case of power failure.
SIZES AND CAPACITIES—In four sizes, 44,000 to 88,000 Btu per hour and 550 to 1,100 cfm. Two smaller sizes 51½ inches high, larger size is 63 inches high. Depth 28 inches for all models. Width 24¾ in two smaller models, 25⅞ inches for larger models.

MADE BY — *International Heater Company, Utica, N. Y.*

Item 106

Electradiant Heating System

NAME — Electradiant heating system.
PURPOSE—Radiant heating system employing electric heating.
FEATURES—System operates on a low voltage, high current principle with thermostatic control. Heating coils are set in a base of light-weight vermiculite insulating concrete. Makers claim that since vermiculite is an insulating material, little heat is lost by the cables into the ground and there is a quicker response to heating controls. Cables may be installed in floors, walls or ceilings without special precautions against fire or electrical shock hazards. Makers claim that for an average five-room house the electrical assembly, including controls and transformer, requires a fraction more space than an ordinary typewriter. System may be broken up into several individually controlled zones so that different temperatures may be maintained in each room.



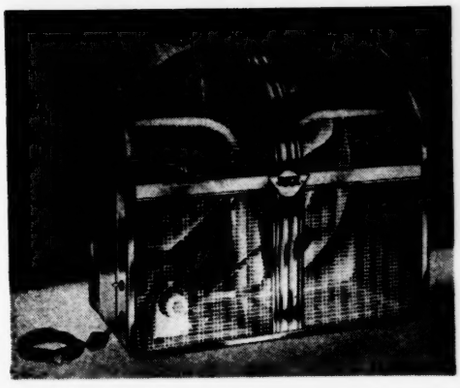
MADE BY—*Electradiant Corporation, 500 Del Monte Ave., Monterey, Calif.*

Item 107

Rex Window Fan

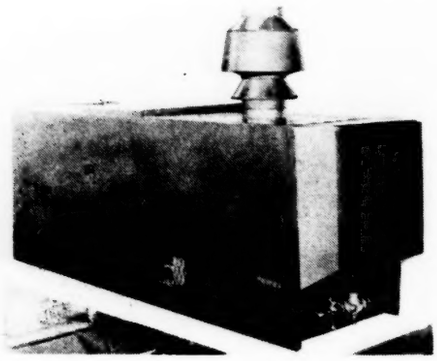
NAME—Rex Headliner window fan, No. W-390.
PURPOSE—Room ventilation.
FEATURES — A deep-pitched, belt-driven, six-blade fan assembly has been designed for quiet and efficient operation. The ¼ hp split-phase, rubber mounted G.E. motor that is used, has automatic overload protection and radio noise filter. A separate reversing switch is provided for exhaust or intake operation.
SIZES AND CAPACITIES — Output, 3,900 cfm.
LITERATURE AVAILABLE—Bulletin.
MADE BY—*Air Controls, Inc., 2310 Superior Ave., Cleveland 14, Ohio.*

Item 108



Zink Central Heater

NAME—John Zink AH-110 central gas heater.
PURPOSE—Completely packaged automatic central heating unit for space heating.

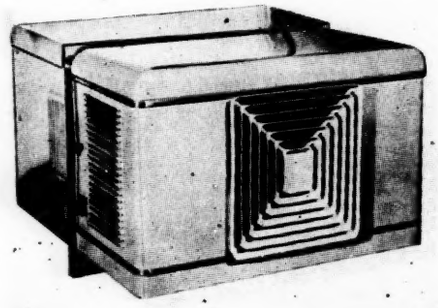


FEATURES — Complete unit, which includes automatic safety shut-off, solenoid valve, firing cock, pressure regulator, and fan-limit control, may be installed in the basement, attic or closet of a home for space heating, using ductwork. It can also be used for an industrial installation as a floor heater or as a duct heater. It is equipped with a blower and two over-sized filters. Unit is designed as a winter air conditioner with a summer switch for air circulation. It is operated by a 1/3 hp motor turning at 1,725 rpm. Plenum chamber measures 16 x 16 inches.
SIZES AND CAPACITIES—Gas connection, ¾ inch; capacity, 110,000 Btu. Dimensions, 20 x 25 x 72 inches.
MADE BY—*John Zink Co., 4401 S. Peoria, Tulsa 1, Okla.*

Item 109

Ajax Air Conditioner

NAME — Ajax roomaster, Model AW-100.
PURPOSE—Room cooling.
FEATURES—Unit is made to fit sliding sash windows without the need of separate frame or installation parts. Cabinet is held by window fit at top groove of cabinet and by adjustable clamp that holds the front edge of the window sill. It fits any window opening 27 inches or wider. Plywood fill-ins are provided for the sides. Air filter is replaceable by removing the cabinet cover. A Servel Supermetic 1-ton compressor is used operating at 1725 rpm, 230 volts, 50- to 60-cycle current. Duplex V-coils of finned copper tubing with mechanically bonded aluminum fins is used. An automatic thermostat fresh air ventilation damper controls the amount of fresh air that enters the room. Cold air is discharged through four-way directional flow grilles.
MADE BY — *Ajax Corporation of America, 176 W. Adams St., Chicago 3, Ill.*



Item 110

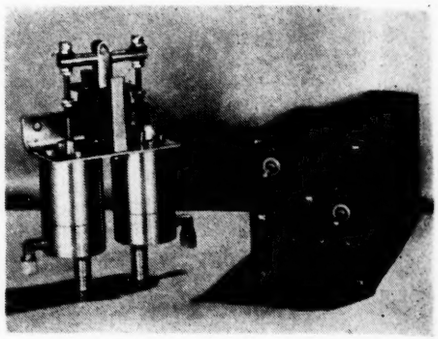
Mixture Cleaner

NAME—Cleaning mixture No. 49.
PURPOSE—A cold liquid cleaner suitable for use on electric motors and generators and for general machine and automotive maintenance.
FEATURES—This formula, which is said to make possible rapid and low-cost cleaning, dissolves grease rapidly and evaporates quickly. It is said to be practically inert to ordinary electrical insulating materials. Mixture is composed of 30% by volume of Blend CC No. 49, available from duPont distributors, and 70% of Stoddard solvent which is generally available. Mixture can be prepared as directed and is not available through duPont outlets.
DEVELOPED BY—*E. I. duPont de Nemours and Co., Inc., Wilmington 98, Del.*

Item 111

Metering Pump

NAME — Electronically controlled metering pump.
PURPOSE — Accurate metering of fluids by remote control.
FEATURES — An electronically controlled solenoid is said to provide a variable control of the number of strokes per unit time. Additional adjustment of the length of stroke is available to a maximum output of 0.8 cu in. per stroke. Unit has a special mechanical sealing arrangement which eliminates stuffing box adjustments. The electronic timer has been designed for many years' operation without replacements. The pump, as well as other working parts of the device, is self-lubricated.



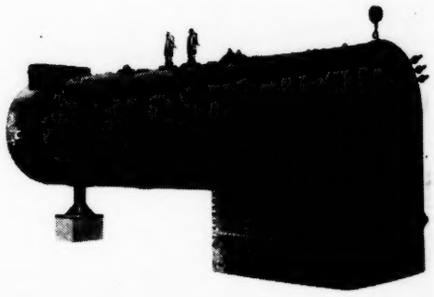
MADE BY—*Eastern Industries, Inc., 296 Elm St., New Haven 6, Conn.*

Item 112

Lucey Steam Boiler

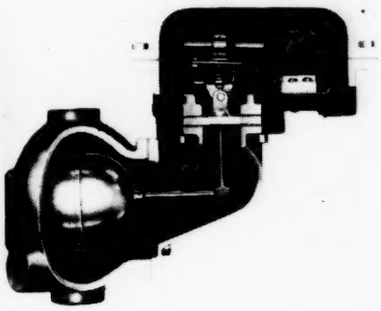
NAME—Lucey high steam reserve boiler.
PURPOSE — High steam boiler for space heating.
FEATURES—Unit, which can be supplied in 40, 60, 85, 104 and 150-hp sizes with working pressures of 150 lb, is adaptable for oil, gas or stoker firing. Large firebox is said to provide more efficient combustion of firing materials. Unit is light in weight and is easy to install. Boiler is sold as a complete installation with fittings and stack, or by the unit.
MADE BY—*Lucey Boiler and Mfg. Corp., Chattanooga, Tenn.*

Item 113



Float Controller

NAME—McDonnell No. 65 explosion proof float operated controller.
PURPOSE — Electric controller for use with water tanks, receivers and liquid storage systems.



FEATURES—Unit was designed for use where a conventional type controller was not applicable. The make or break circuits at either high or low levels can be used for controlling motors, signal lamps, and electrical elements. Unit has been approved by the Underwriters for use with atmospheres containing hazardous vapors. The float switch incorporates the McDonnell packless construction, heavy duty mercury switch and totally enclosed wiring and terminals. It is supplied with a switch that breaks the circuit with falling liquid level but a reverse acting switch is available for completing the circuit with falling level. Float chamber is of heavy cast iron. The float is copper; bellows are bronze; the float rod is brass. Maximum body pressure is 40 lb.
LITERATURE AVAILABLE—Circular.
MADE BY—*McDonnell & Miller, Inc., Wrigley Bldg., Chicago 11, Ill.*

Item 114

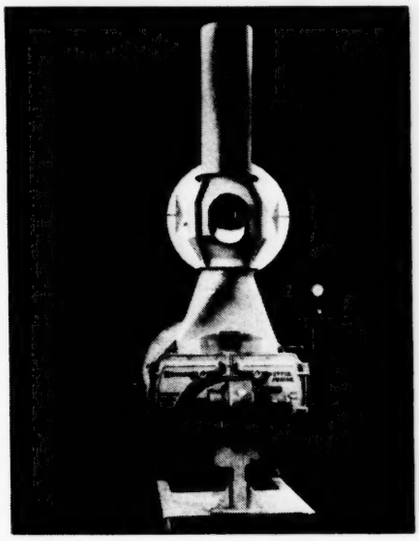
Fire Proven Tankless Heater

NAME—Fire Proven water heater.
PURPOSE—For the tankless generation of domestic hot water.
FEATURES—A new method of coil fabrication is said to eliminate all internal soldered connections. Air is automatically vented. A welded steel shell with welded-in head is used, to which coils are attached with bronze connectors. Heating surface has been designed for a minimum pressure drop and high transfer efficiency. The domestic water side is made entirely of bronze and copper. An aquastat tapping is provided.
SIZES AND CAPACITIES—Three sizes available—3¾, 5, and 8 gpm.
MADE BY—*Fire Proven Products, Inc., 1605 Court Square Bldg., Baltimore 2, Md.*

Item 115

Bifurcator Fan

NAME—Bifurcator Fan.
PURPOSE—An induced draft fan for boiler application.
FEATURES—Unit consists of a direct motor driven fan with a divided housing. Motor is placed in an isolated asbestos lined chamber around which flue gases are bypassed. Fan can be installed in vertical stack or horizontal or angular breeching, just like a section of pipe.

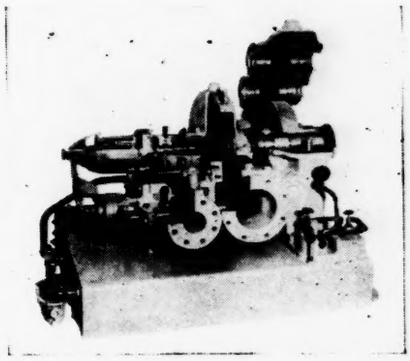


SIZES AND CAPACITIES — In sizes from 12 through 27 inch diameter for boilers from 6 to 350 hp for operating temperatures up to 650F.
LITERATURE AVAILABLE — Bulletin DB-22-50.
MADE BY—*DeBothezat Fans Division, American Machine and Metals, Inc., East Moline, Ill.*

Item 116

Westinghouse Gearturbine

NAME—Westinghouse type E gearturbine.
PURPOSE—Steam turbine with close coupled, integral reduction gears for low-speed applications for equipment such as pumps, fans and compressors.
FEATURES — Unit combines a rugged, compact speed reduction mechanism solidly coupled to the turbine and designed to operate as a single unit. Single helical gears with low helix angle give low thrust against bearings. Endwise movement of one shaft does not affect axial location of the other, and thrust, it is said, is not transferred from the gears to the turbine. Turbine and gear are factory aligned on a single, heavy plate steel base which also serves as an oil tank. Turbine is shipped as a completely assembled unit ready to install. Unit is available with standard gear reduction ratios.



MADE BY — *Westinghouse Electric Corp., Pittsburgh 30, Pa.*

Item 117

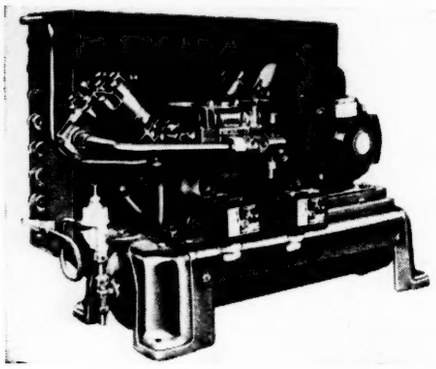
Pac-Air

NAME — Pac-Air portable compressors.
PURPOSE — A self-contained air-cooled gasoline engine driven compressor for use by contractors.
FEATURES—The two-cylinder single stage compressor has a piston displacement of 37.5 cfm at 80 lbs per sq in. It is equipped with an automatic unloader to enable the compressor to operate at constant speed but compress air only when needed. Compressor and gasoline engine driver are mounted on an air receiver which forms an integral part of the running gear. A special trailer hitch is provided so that it can be towed behind a truck.
MADE BY—*Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.*

Item 118

Lehigh Defrost Unit

NAME—Automatic high-side defrost condensing unit.
PURPOSE—Defrost unit for use with any type evaporator.



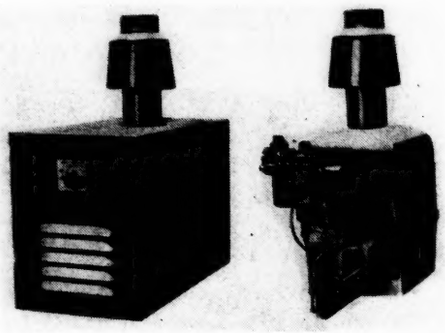
FEATURES—Based on the principle of pressure-temperature relationship, this unit defrosts the evaporator automatically whenever the efficiency drops to a predetermined point. After complete defrost, which is extremely rapid, the unit returns to freezing automatically. The low and high pressure controls, both reverse acting, are used to start the defrost cycle and to revert to cooling. Controls energize a solenoid operated 4-way reversing valve which completely reverses the flow of refrigerant. Valve and controls are factory assembled and form an integral part of the unit. Heat for the defrost is obtained from the unit high-side condenser which, on the defrost cycle, serves as the evaporator.

LITERATURE AVAILABLE—Bulletin.
MADE BY—*Lehigh Manufacturing Co., Lancaster, Pa.*

Item 119

Midget Heating Plant

NAME—Hook & Ackerman gas-fired hot water heating system, model 2HW2.
PURPOSE—Gas-fired heating system designed for individual apartments consisting of 4 to 5 rooms.
FEATURES—Of cast iron construction, unit measures 13 inches wide by 26 inches deep by 17 inches high. Because of its small size, it can be suspended from the ceiling or arranged on a wall shelf. Unit comes



completely assembled and does not require any electrical connection.
SIZES AND CAPACITIES—AGA input rating of 45,000 Btu to supply 188 sq ft standing radiation.
MADE BY—*Hook & Ackerman, Inc., 18 E. 41st St., N. Y.*

Item 120

Whittington Pump

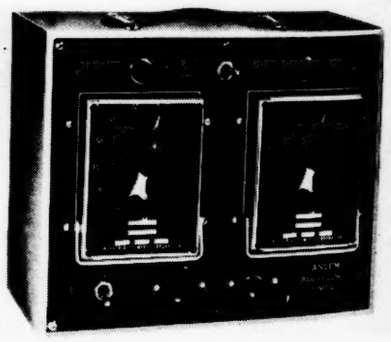
NAME — Whittington condensation pump, Series HC horizontal.
PURPOSE — Compact pumping unit for handling condensate.
FEATURES—Unit is designed for compactness and is provided with bronze fitted close-coupled centrifugal pumps operated by drip-proof motors. Unit has a flange mounted double-pole float switch, a rotary seal, and Cor-Ten welded steel tank. This tank has an air space beneath to prevent corrosion.
SIZES AND CAPACITIES — Available in single and duplicate models in capacities from 10,000 to 100,000 sq ft EDR, and 20 and 40 lb pressure for single- and three-phase current.
MADE BY—*Whittington Pump and Engineering Corp., Indianapolis, Ind.*

Item 121

Tandem Recycling Timer

NAME—Tandem recycling timer.
PURPOSE — Two individual timing elements designed to control a specific operation.
FEATURES — When timer dials are set to respective time intervals required, each cycle of operation will follow the other continuously in regular sequence. Sequence can be maintained indefinitely, for no adjustments are required until new time intervals are necessary. Cabinet has two sockets into which the timing elements are plugged so that they control a single pole, double-throw load relay. On and off toggle switch, load control switch, and pilot lamp are integrated with other components to give a compact unit.
MADE BY — *Industrial Timer Corporation, Newark, N. J.*

Item 122



MARCH, 1950

TO OBTAIN FURTHER INFORMATION ON NEW EQUIPMENT

On the list below, circle the item number of the equipment in which you are interested, using the number found at the end of each item.

81	82	83	84	85	86	87
88	89	90	91	92	93	94
95	96	97	98	99	100	101
102	103	104	105	106	107	108
109	110	111	112	113	114	115
116	117	118	119	120	121	122

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NEWS OF THE MONTH

PROTECTIVE CONSTRUCTION

for strategic plants urged by engineer after Government study of underground construction.

The use of protective construction methods to safeguard uninterrupted production at future strategic industrial plants, including new atomic energy facilities, is advocated by Guy B. Panero, nationally known engineer, whose firm last year completed a major study for the Government on feasibility of underground construction.

He described protective construction as including not only underground plants and dispersal over large ground areas, but also specially developed construction and planning techniques designed to give optimum protection to the most critical portions of a single plant.

• **ECONOMICS.**—It is not practical or desirable to place all, or even a major segment of important manufacturing facilities such as atomic plants underground, Mr. Panero said. Nor would it be economically feasible to disperse some types of industry. But the time is opportune to consider protective construction for those production facilities which are absolutely necessary to the defense of this nation. Sites must be selected and structures must be designed to offer the maximum degree of protection consistent with economic aspects of our industrial complex.

Mr. Panero pointed out that a report released by the Atomic Energy Commission and the Department of Defense stated that 320,000,000 sq ft of floor space is available in existing mines which can be converted into first-class production areas at a cost only slightly higher than conventional above-ground buildings.

The Panero firm, in a $400,000 survey conducted for the Corps of Engineers, Department of the Army, actually designed three different types of plants for location in underground sites, and comparative cost studies were made with similar conventional structures. The plants designed included a precision manufacturing plant, a chemical plant, and a storage depot. They have not been constructed.

• **PRACTICALITY.**—Many highly competitive industries are potentially necessary to the defense of the United States, Mr. Panero said. To speak of a mass return to the cave-man era through the erection of unlimited underground plants is to speak of an unattainable and impractical goal. Nor should we expect mass migrations of entire industries from one section of the country to other sections for the sake of security through dispersal.

Protective construction must therefore provide an equitable solution for each plant on an individual basis and take into account all competitive aspects of the business. This must be the primary requisite of any nation-wide program of protective construction—to give optimum protection within the economic framework established over long years of practice.

NATIONAL SMOKE SURVEY

by foundry industry covers principal cities. Lack of standards noted.

For the first time, a national survey of smoke and "smog" prevention problems has been made by the foundry industry, according to a report from Raymond L. Collier, executive vice president of the Gray Iron Founders' Society, Inc., Cleveland. More than forty leading smoke abatement and air pollution officials of the principal state and municipal organizations throughout the country were consulted in the study and thirty-four officials—79%—contributed information to the survey.

• **CODES.**—Conclusions of the study are now being circulated to foundrymen in more than 500 plants, it was learned. Main points developed include disclosures that no state codes contain any limitations on dust "loading" in flue gases. Such codes as exist are confined to municipal ordinances, and even here there is no generally recognized standard, according to the G.I.F.S. The standard most frequently encountered, it was stated, is a limit of 0.40 grains of dust per cubic foot.

The national study was undertaken by the G.I.F.S., it was pointed out, because the City of Los Angeles has issued what is virtually an "ultimatum" to foundries in that location, that summary demands for smoke abatement must be met. Foundrymen have asked whether or not failure to comply would not mean that some plants would have to move out of the Los Angeles area. At the conclusion of the survey the local situation in Los Angeles remained unsettled. The problem was cited to foundrymen throughout the country, however, as an example of conditions which may arise if no proper basis for technical analysis is developed for use by local communities.

• **LARGE PARTICLES.**—In the summary of conclusions Mr. Collier pointed out that dust particles from cupolas used in foundries, according to the G.I.F.S. research, are "large from a micron standpoint, and normally settle out rather quickly from the atmosphere due to their weight and size." For this reason they are not widely dispersed throughout the surrounding atmosphere and land area.

Points which should be held in mind by experts studying community air-pollution problems throughout the country are that foundrymen themselves are reasonable and anxious to retain and merit the esteem of the public, Mr. Collier continued. He said foundrymen do not want to create public nuisances, and he cited the opinions of dust-suppression experts that foundry operators "deserve a sympathetic and understanding treatment."

For guidance of air-pollution analysts the survey pointed out that "the best reference of which we have knowledge" on the concentration limits of dust in at-

mospheres "is the standard recommended by the American Society of Mechanical Engineers." This calls for a limit of 0.45 grains per cubic foot of effluent gases. But even such a limit, it was stated, is questioned by the Director of Industrial Hygiene for one of the large cities, according to the survey. Instead, the study continued, in some cities a "rule of reason" is applied which does not prescribe rigid limits.

In order to determine the size of the problem on a national basis, city smoke-prevention experts were asked about the number of complaints received relating to operation of foundry cupolas. Twelve cities said they had no such complaints. Three cities said they had numerous complaints. Foundrymen took the view in analyzing these replies that although most of the reports indicate either no problem or a problem of no great severity, even if only one city had a severe problem, industry members should study corrective steps.

• **TYPICAL CASES.**—By reporting individual cases of improvements in equipment design, in the survey, it was shown how much of the dust problem has been eliminated by eight typical cases. Adverse risks for business were also shown, since reports revealed that one small foundry had gone out of business because of inability to pay the cost of corrective measures which would have been required to reduce dust output. To aid other foundrymen in studying possibilities for reducing dust by installing new equipment, complete photographs and descriptions of available dust prevention devices were provided in the complete report of the national study.

Final recommendations reached, according to Mr. Collier, included a broader realization that dust suppression is a relatively new science and that cooperation between officials and foundrymen will go far toward obtaining rapid improvements. It must also be realized that there are no standard tests to determine the improvement brought about by installation of dust suppression units, and further research in this direction is indicated.

The foundry industry also recommended that a "correlating board in the professional organization of smoke commissioners, hygienists" and others should be set up to maintain up-to-the-minute information in this field.

NEWS BRIEFS

• Aldo Macchi of the General Electric Company's Air Conditioning Department has been awarded a patent covering a burner head for use in oil-fired boilers, it was announced recently by the company's Patent Department. It is the 11th patent awarded to him. The patent covers improvements which provide better cooling of the electromagnetic oil flow control valve and atomizing nozzle parts, and permit the parts to be easily removed and disassembled for cleaning and repair purposes. In addition, an oil and air pressure atomizing nozzle structure, which can be varied to provide different oil rates, is included.

• Live steam to cool fresh vegetables has been used commercially by California lettuce shippers for more than a year, and the U. S. Department of Agriculture has tested it with other products with promising results. For cooling, the vegetables are placed in an airtight metal chamber and the loading opening is sealed. Then a high pressure flow of steam is used to create a vacuum and suck the air out of the cooling chamber. Water evaporates from the surface and tissues of the vegetables. Changing the water from the liquid to the vapor form requires heat. This is drawn from the vegetables within the chamber and results in their quick cooling.

• Part of the modernization and development program of Bombay, India, is the air conditioning plant at Shangrila Food Products, Ltd., which was installed by the Blue Star Engineering Co., Ltd., the representative in India of United States Air Conditioning Corp. of Minneapolis. Two hundred and fifty thousand cubic feet of space in the Shangrila factory are air conditioned with 6 usAIRco air conditioning plants.

• Three separate contracts aggregating a total expenditure of $5 million over the past eight years have been completed as part of the expansion program of Bethlehem Steel Co. New buildings include completely air conditioned office space and a new Charles M. Schwab Memorial Library.

• Contracts awarded for building and engineering works in the 37 cities east of the Rocky Mountains last year totaled $10.4 billion, a gain of 10% over 1948 and a new all-time dollar volume contract record, according to F. W. Dodge Corporation.

• **AIR POLLUTION** was the subject of panel discussions at the February 13 meeting of the Western New York Chapter, ASHVE. Participating, left to right above, were: John Kane, American Air Filter Co.; Roy Warren, Buffalo Forge Co.; Glen Hickey and Otto Wolfe, National Aniline Co.; and William Heath, Buffalo Forge Co.

• Congressman Ivor D. Fenton (R., Pa.) has introduced a resolution calling for creation of a joint committee on fuel policy. Mr. Fenton is concerned about conservation of petroleum and natural gas resources. The joint committee would be composed of 14 members, 7 from each branch of the Congress. The resolution has been referred to the House Committee on Rules.

SURVEY OF CONTRACTORS

shows extreme competition prevailing in construction industry and public building construction increasing.

What may be the fiercest competition since the middle 1930's appears to be prevailing in the general contracting industry in the construction of buildings, highways, railroads, public utilities, dams and other engineering projects, according to a survey of current construction conditions among general contractors.

A large volume of work is coming on the market, indicating that 1950 can be another year of a record volume of construction activity on a national scale.

• **STABILIZED.**—Construction costs have stabilized or are tending to stabilize at approximately 10% below the peak of 1948. There appears little likelihood of a drastic change in cost trends immediately.

Contractors report an adequate supply of materials, machinery and manpower generally, with continued increases in labor productivity and efficiency of contracting organizations.

These factors indicate that the public is receiving full value for its investment in construction.

These are the principal facts resulting from a survey of current construction conditions conducted by The Associated General Contractors of America for study at its 31st annual convention February 27-March 2 at the Palace Hotel in San Francisco.

The survey was conducted among the A.G.C.'s 110 local affiliated organizations, and among its directors, throughout the United States and in Alaska, representing more than 5,500 leading firms which annually perform an estimated 80% of the nation's contract construction.

• **RECORD.**—The association will study major problems to be encountered by the industry in performing a possible record $30,000,000,000 total construction volume during 1950, with $20,000,000,000 in new construction and the remainder in maintenance and repair operations.

The survey conducted in February brought results similar to one conducted last September by the association. The principal change was in the continued increase in competition.

Building construction costs, for industrial, commercial and large scale residential projects, were reported to have largely stabilized at an average 8.5% below the peak.

Highway construction costs, including airports, were reported at an average 12.8% below the peak, with decline in costs continuing in many areas.

Heavy construction costs, for railroads, bridges, dams, waterworks and other similar type projects, were reported stabilized at an average 10%.

While 1949 was a year of marked competition among contractors, the survey replies indicated that 1950 has ushered in a period of extreme competition, with some instances cited of more than 30 bidders on one job.

Contractors were cutting overhead expenses to the bone in order to achieve peak efficiency and stay in the competition.

Competition was reported alternately as "stimulating", "healthy", "fierce", "hellish", "rugged", and "dangerous."

Although construction wages were up, many reported these costs offset by increased productivity of labor.

• **MAJOR POINTS.**—Replies to major points in the survey, which represent the opinions of hundreds of general contractors who were consulted by chapter and branch executives and directors, follow:

Costs: 50.5% reported costs have stabilized; 42.5%, costs still tending downward; 4.4%, costs unchanged; 2.6%, going up slightly.

The average cost stabilization reported was 9.9% below the postwar peak, slightly lower than reported in the A.G.C. survey of last fall.

Volume: 44.3% reported more work coming on the market, while 34.5% reported volume unchanged from the recent high levels. However, 20.4% reported less work coming on the market, and a few did not answer this question.

Last fall, 50% reported more work coming on the market; 14%, unchanged; and 31%, less work.

Materials: 95.7% reported an adequate supply of materials. Some reported a possible shortage of cement or steel during the coming summer, and were concerned with the length of the coal strike.

Equipment: Practically all the replies reported an adequate supply of construction machinery.

Manpower: 96.5% reported an adequate labor supply, compared with 94% last fall. The other 3.5% expected shortages to develop in some building trades next summer, particularly the trowel trades.

Productivity: Increased worker productivity was reported by 92.9% of the replies, compared with only 79% last fall. The remaining 7.1% reported no change in productivity.

Competition: 100% reported greatly increased competition between contractors, and between sellers of equipment and material.

• **BUILDING.**—Most building contractors reported costs stabilized; 58.4% work volume unchanged; and 41.6%, increased amount of work coming on the market.

Principal factors resulting in the stabilization of building costs were cited as fewer work stoppages; increased worker productivity and efficiency in contracting organizations; the stabilization of material and equipment prices; and greatly increased competition among bidders.

More public work is coming on the market, while private construction is dropping off in this work. It was indicated that the "postwar rush" is over.

NEW CATALOGS

Tube Turn Engineering Data Book

Designated as catalog and engineering data book No. 211, a new edition in the Tube Turn bound, tab-indexed, 262-page volume of practice and engineering information is ready for distribution. Similar in format to catalog No. 111, the new volume carries additional material for designers and contractors of industrial piping systems. Each copy will be registered in the name of its owner so that he can be supplied with supplementary data as they are issued. Distribution will be restricted to major users, designers and erectors of industrial piping. Copies should be requested on company letterhead direct to *Tube Turns, Inc., Louisville 1, Ky.*

Aluminum Extrusions Design Guide

Designing With Aluminum Extrusions is a 138-page spiral bound volume presenting basic engineering factors in the use of extruded aluminum shapes. The book breaks down the advantages of the extrusion process into eight principles of design, each of which is illustrated and explained by diagrams, charts and photographs. The tabular section presents 22 pages of data on chemical, mechanical and physical properties. Copies are available without charge but should be requested on company letterhead direct to *Reynolds Metals Co., 2500 S. Third St., Louisville 1, Ky.*

Steam Generators

Cleaver-Brooks self-contained steam boilers for processing and heating are described and illustrated in a 12-page catalog. Photographs and cutaway drawings illustrate working principles and applications of the line.—*Cleaver-Brooks Company, 326 E. Keefe Ave., Milwaukee 12, Wis.*

Item 33

Air Handling

Progress in handling of air is shown in photographs and text included in Volume 5 of a series of advertisements.—*American Blower Corp., P. O. Box 58, Roosevelt Park Annex, Detroit 32, Mich.*

Item 34

Summer-Winter Air Conditioning

Electro-mechanical air conditioning for summer and winter control of atmosphere in railway cars is the subject of a 12-page bulletin. Performance data and approximate weights of equipment including direct and belt driven evaporative condensers, air cooled condensing units, and air conditioners are included.—*The Safety Car Heating and Lighting Company, Inc., 1455 Railway Exchange, 80 East Jackson Blvd., Chicago 4, Ill.*

Item 35

Instantaneous Water Heaters

Patterson instantaneous hot water heaters and heat exchangers are covered in a 36-page thumb-indexed bulletin showing typical piping arrangements, selection and sizing data, and capacities of 2-, 4-, and 6-pass heaters at various temperatures. — *Patterson-Kelley Co. Inc., 3 Wilson Ave., East Stroudsburg, Pa.*

Item 36

High-Speed Generators

A new 8-page, 2-color bulletin, GEA-5415, on Tri-Clad high-speed synchronous generators, deals with generators for standby, portable, and prime source power and gives construction features, mechanical modifications, and performance data. Ratings from 12½ kva to 1,250 kva and speeds from 1,800 rpm to 514 rpm are covered.—*General Electric Co., Schenectady 5, N. Y.*

Item 37

Unit Air Conditioners

Four sizes of Brunner self-contained packaged air conditioners are described and illustrated in a 6-page bulletin with tables of capacities and operating data on 3 hp, 5 hp, 7½ hp and 10 hp units.—*Brunner Manufacturing Co., Utica 1, N. Y.*

Item 38

Brad-Ray Warming System

A simplified method of installing ceiling radiant heating panels with loops and headers instead of serpentine coils is described in an 8-page bulletin with illustrations of design calculations and methods of installation. A graphical method of supply and return line sizing is presented.—*Joseph L. Bradfield, 10 North Senate Ave., Indianapolis, Ind.*

Item 39

Axial Flow Fans

Bulletin AAP-101, 20 pages, 2 colors, describes and illustrates the AirFlo axial airfoil propeller fan. Characteristics, specifications, and fan selection data are included, with additional data covering exhaust hood velocities, friction losses in ducts, and performance tables showing various operating conditions.—*Chicago Blower Corp., 4558 West Congress St., Chicago 24, Ill.*

Item 40

Synchronous Motors

A new 8-page, 2-color bulletin on Tri-Clad high-speed synchronous motors, designated publication GEA-5426, lists some of the applications for these motors, such as driving pumps, grinders, compressors, saws, beaters, fans, generators, conveyors, mixers, etc. The bulletin discusses construction features, mechanical modifications, and direct-connected exciters for the motors, which are furnished in ratings from 20 to 1500 hp at 60-cycle speeds of 1800 rpm, as well as proportional hp ratings for speeds through 514 rpm. —*General Electric Co., Schenectady 5, N. Y.*

Item 41

Small Motor Selection Data

A 4-page Small Motor Selector (B-3075-C) explains why there are different types of fractional horsepower motors, and the factors to be considered in selecting. Center pages form a large chart and present in tabular form the various types of small motors, together with complete data concerning horsepower range, speed characteristics, torque, reversibility, bearings, mountings, and application. Typical speed-torque curves for various types of fractional horsepower motors are included, together with information on specialized standard designs for specific applications, such as stokers, washing machines, hoists, etc.—*Westinghouse Electric Corp., Box 2099, Pittsburgh 30, Pa.*

Item 42

Steam Generators

A series of seven pieces of literature describes the complete line of York Power Steam-Pak Generators. Models include gas, oil, and combination fired units. Literature includes specifications and dimensions of each series.—*York-Shipley, Inc., York, Pa.*

Item 43

Dust Collector Selection

Rapid selection of correct size unit type dust collectors for industrial dust problems requiring from 200 to 3600 cfm is given in Bulletin 610. A tabulated comparison of all units in the line includes wheel size recommendations and a method for determining correct air suction required at any wheel in accordance with New York State Code requirements.—*Aget-Detroit Co., Ann Arbor, Mich.*

Item 44

Gas Compressibility Charts

Bulletin (F-7637) — Compressibility Charts and Their Application to Problems Involving Pressure-Volume-Energy Relation for Real Gases — contains mathematical analyses of gas compressibility, horsepower equations and flow through nozzles, and charts for the solution of problems.—*Worthington Pump and Machinery Corp., Harrison, N. J.*

Item 45

Motor Control Manual

The 4th edition of the Allen-Bradley manual on motor control comprises 76 pages of condensed sizing and performance data, and prices of the more popular items in the line.—*Allen-Bradley Co., Milwaukee 4, Wis.*

Item 46

Vacuum Hose

Industrial vacuum hose, which handles dust, abrasive scrap and toxic fumes in many industries, is pictured and described in catalog section 4780.—*The B. F. Goodrich Co., Akron, Ohio.*

Item 47

Ric-Wil Data Books

Two new technical data books cover problems involving insulated piping systems. The Ric-Wil "Insulated Piping System Catalog—Section 480-4" illustrates and describes the manufacture, construction, and installation of various types of insulated piping. Technical data on piping systems and available services are also included. "Insulated Piping System Technical Data—Section 480-5" contains illustrated technical data and specifications on all phases of insulated piping, its structure, properties, and installation procedures.—*The Ric-Wil Company, Dept. J-1, Union Commerce Building, Cleveland, Ohio.*

Item 48

Cycoil Air Filters

Manual 130-E covers new designs and improvements in American Cycoil oil bath air and gas cleaners. New sizes have been added to the WO1 air cleaner series and a new design (WO3) has been introduced. The WO3, identical with the Model WO1 except the intake is tangential instead of peripheral, permits control of the air intake or the addition of an extension for use with an intake unloading compressor. Both the UO4 (low pressure) and the UO7 (high pressure) gas cleaners have been re-designed for wider ranges of working pressures. Selection charts, dimension tables and detailed engineering data are included. Issued free upon request.—*American Air Filter Co., Inc., Louisville, Ky.*

Item 49

Flame-otrol Bulletin

An explanatory bulletin on the new Flame-otrol combustion safeguard for oil and gas fired furnaces, ovens, boilers, kilns and other heating equipment, has been released.—*Wheelco Instruments Co., Chicago 7, Ill.*

Item 50

Fan Catalog

A new Emerson-Electric, 60th anniversary fan catalog, illustrates in color and describes in detail their complete line of fans for 1950.—*The Emerson Electric Mfg. Co., St. Louis 21, Mo.*

Item 51

MARCH, 1950

TO OBTAIN COPIES OF TRADE LITERATURE listed in this issue, circle on the list below the publication wanted, using item number at the end of each review. Print your name and address, mail to

Editor, HEATING AND VENTILATING,
148 Lafayette Street, New York 13, N. Y.

33	34	35	36	37	38	39	40	41	42
43	44	45	46	47	48	49	50	51	

Name.....

Title (Must be shown).....

Firm (Must be shown).....

Business Address.....

City.....Zone....State..... 3/50

DEGREE-DAYS FOR JANUARY, 1950

(A) Airport readings; (C) City office readings; (O) Readings at a point on outskirts of city.

HEATING AND VENTILATING's 22nd Year of Publication of Monthly Degree-Day Data

City	January			Cumulative, September 1 to January 31			Heating Season[1]
	1950	1949	Normal	1949-50	1948-49	Normal	Normal
Abilene, Texas (A)	541	918	326	1411	1868	1251	2061
Albany, New York (A)	1046	1119	1287	3532	3473	3726	6580
Albuquerque, New Mexico (A)	845	1075	924	2525	2968	2751	4298
Alpena, Michigan (C)	1256	1196	1431	3985	3718	4382	8299*
Anaconda, Montana (C)	1610	1871	1321	4753	5337	4492	8357**
Asheville, North Carolina (C)	407	543	831	1938	2052	2520	4232
Atlanta, Georgia (C)	296	414	682	1375	1420	1813	2890
Atlantic City, New Jersey (C)	634	726	992	2066	2162	2727	5176
Augusta, Georgia (A)	216	260	555	996	972	1441	2161
Baker, Oregon (C)	1453	1785	1218	4085	4944	4033	7163
Baltimore, Maryland (C)	562	702	955	1923	2109	2619	4533
Billings, Montana (A)	1857	1729	1318	4617	4546	4134	7119
Binghamton, New York (C)	886	1013	1268	3200	3257	3783	6808
Birmingham, Alabama (A)	218	393	589	1260	1375	1502	2352
Bismarck, North Dakota (A)	2334	1934	1807	5739	5292	5321	9192
Block Island, Rhode Island (C)	755	844	1048	2383	2452	2784	5788
Boise, Idaho (A)	1222	1692	1097	3552	4306	3382	5552
Boston, Massachusetts (A)	886	940	1150	2737	2710	3280	6045
Boseman, Montana (C)	1614	1852	1403	4663	5180	4689	8521**
Buffalo, New York (A)	926	1045	1240	3199	3164	3612	6822
Burlington, Iowa (A)	1187	1277	(a)	3353	3552	(a)	(a)
Burlington, Vermont (A)	1191	1237	1429	3855	3724	4202	7514
Butte, Montana (C)	1651	1945	1309	4927	5640	4492	8235**
Cairo, Illinois (C)	628	742	908	1945	2077	2407	3909
Canton, New York (C)	1218	1295	1520	4033	3834	4514	8020
Charleston, South Carolina (C)	150	207	487	735	647	1119	1769
Charlotte, North Carolina (C)	356	414	725	1486	1447	1945	3120
Chattanooga, Tennessee (A)	334	477	732	1633	1741	1957	3118
Cheyenne, Wyoming (A)	1265	1578	1215	3904	4516	4104	7466
Chicago, Illinois (C)	1020	1080	1190	3002	3048	3362	5957
Cincinnati, Ohio (C)	658	756	1017	2169	2333	2813	4684
Cleveland, Ohio (A)	868	934	1181	2943	2984	3366	6155
Columbia, Missouri (C)	931	1092	1110	2621	2858	3006	4922
Columbia, South Carolina (C)	250	280	586	1126	1043	1502	2364
Columbus, Ohio (C)	761	855	1113	2581	2675	3133	5398
Concord, New Hampshire (A)	1156	1159	1349	3862	3688	4081	7353
Concordia, Kansas (C)	1227	1419	1184	3074	3481	3203	5315
Dallas, Texas (A)	516	780	617	1290	1612	1487	2256
Davenport, Iowa (C)	1200	1264	1352	3411	3434	3685	6289
Dayton, Ohio (A)	820	919	1116	2855	2963	3063	5264
Deer Lodge, Montana (C)	1624	1959	1376	4865	5616	4894	8672**
Denver, Colorado (C)	1039	1409	1079	2914	3622	3355	5874
Des Moines, Iowa (C)	1379	1423	1392	3552	3671	3762	6384
Detroit, Michigan (A)	997	1035	1252	3224	3183	3584	6490
Devils Lake, North Dakota (C)	2436	1999	1949	6224	5614	5820	9970
Dodge City, Kansas (A)	1089	1342	1116	2835	3378	3068	5035
Dubuque, Iowa (C)	1341	1336	1442	3714	3729	3976	6790
Duluth, Minnesota (C)	1902	1579	1727	5313	4706	5216	9483
Eastport, Maine (C)	1182	1201	1380	3719	3734	4270	8250**
Elkins, West Virginia (A)	694	758	1048	2836	2927	3265	5697
El Paso, Texas (A)	484	899	629	1553	2048	1667	2428
Ely, Nevada (A)	1382	1836	(a)	4240	5176	(a)	(a)
Erie, Pennsylvania (C)	830	929	1172	2801	2831	3336	6273
Escanaba, Michigan (C)	1525	1337	1550	4445	4062	4688	8771
Evansville, Indiana (A)	698	807	949	2316	2450	2494	4244
Fort Smith, Arkansas (A)	637	827	850	1877	2094	2027	3147
Fort Wayne, Indiana (A)	975	1028	1194	3181	3250	3405	5925
Fort Worth, Texas (A)	540	806	580	1346	1602	1406	2148
Fresno, California (A)	686	785	583	1710	1868	1494	2334
Galveston, Texas (C)	127	352	353	398	637	683	1016
Grand Junction, Colorado (A)	1291	1428	1233	3476	3890	3511	5548
Grand Rapids, Michigan (C)	1077	1075	1262	3297	3256	3659	6535
Green Bay, Wisconsin (C)	1530	1365	1538	4453	4043	4420	7825
Greensboro, North Carolina (A)	469	536	772	1901	1931	2167	3529
Greenville, South Carolina (A)	397	444	744	1620	1558	2078	3380
Harrisburg, Pennsylvania (A)	771	873	1088	2651	2781	3069	5375
Hartford, Connecticut (A)	939	963	1159	3076	3033	3316	6036
Hatteras, North Carolina (C)	214	395	589	902	1009	1316	2571
Havre, Montana (C)	2379	1911	1624	5618	5240	4938	8700
Helena, Montana (A)	1998	1998	1375	5239	5457	4433	7894**
Houston, Texas (C)	158	420	366	516	809	815	1157
Huron, South Dakota (A)	1930	1776	1650	4791	4733	4735	8004
Indianapolis, Indiana (A)	852	958	1128	2813	2994	3130	5298
Jackson, Mississippi (A)	215	372	(a)	969	1120	(a)	(a)
Kansas City, Missouri (A)	1075	1214	1141	2674	2935	3007	4956
Knoxville, Tennessee (A)	407	513	815	1762	1870	2298	3670
La Crosse, Wisconsin (A)	1610	1473	1535	4428	4232	4313	7322
Lander, Wyoming (A)	1460	1975	1436	4499	5212	4511	7947

(a) Data not available.

[1]Figures in this column are normal totals for a complete heating season, September to June, incl.

Figures in this table, with seven exceptions, based on local weather bureau reports. Exceptions are Utica and Lewiston, figures for which are furnished through the courtesy of Coke Sales Department, Central New York Power Corp., Utica, N. Y., and Norman E. Ross, Bursar, Bates College, Lewiston, Me., respectively; Anaconda, Bozeman, Butte, Deer Lodge and Livingston, Mont., through the courtesy of the Montana Power Company.

[Table concluded on page 102]

for Water Condenser Lines

● Revere Red-Brass Pipe has been used for many years in residential, industrial, commercial, institutional and municipal construction. It is highly resistant to corrosion and can be used where relatively high velocities exist.

Revere Red-Brass Pipe is 85% copper. It is made in standard pipe sizes for use with threaded fittings. In new construction, this pipe has kept the average cost for maintenance and repair surprisingly low. In existing construction, this pipe should be considered where pipe of other material has proved unsatisfactory.

Revere also provides Copper Water Tube for use with solder or compression fittings; type B Copper Tube, for installations requiring outside diameters of SPS pipe and brazed fittings; and Copper Pipe for use with threaded fittings. Every length of Revere pipe and tube is marked with the name Revere. Look for this mark as your assurance of top quality.

Revere pipe and tube are handled by leading distributors in all parts of the country. The Revere Technical Advisory Service is always glad to serve you.

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COPPER AND BRASS INCORPORATED

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Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.
Sales Offices in Principal Cities, Distributors Everywhere.

Degree-Days for January, 1950 (Concluded)

(A) Airport readings; (C) City office readings; (O) Readings at a point on outskirts of city.

HEATING AND VENTILATING's 22nd Year of Publication of Monthly Degree-Day Data

City	January			Cumulative, September 1 to January 31			Heating Season[1]
	1950	1949	Normal	1949-50	1948-49	Normal	Normal
Lansing, Michigan (A)	1080	1142	1336	3585	3514	4001	7048
Lewiston, Maine (O)	1241	1199	1452	3826	3578	4289	7707
Lincoln, Nebraska (C)	1388	1503	1311	3400	3786	3512	5999
Little Rock, Arkansas (A)	494	671	719	1568	1808	1798	2811
Livingston, Montana (C)	1576	1656	1220	4224	4526	3951	7245**
Los Angeles, California (C)	443	562	326	857	1072	750	1504
Louisville, Kentucky (A)	630	726	939	2162	2314	2526	4180
Lynchburg, Virginia (A)	529	619	856	2032	2158	2413	3980
Macon, Georgia (A)	164	288	549	993	1084	1446	2201
Madison, Wisconsin (C)	1373	1356	1500	3919	3858	4258	7429
Marquette, Michigan (C)	1517	1302	1500	4467	4079	4554	8693*
Memphis, Tennessee (A)	465	603	744	1611	1770	1871	2950
Meridian, Mississippi (C)	177	317	552	1052	1106	1435	2160
Milwaukee, Wisconsin (A)	1237	1225	1383	3724	3609	3984	7245
Minneapolis, Minnesota (A)	1800	1579	1609	4607	4358	4550	7850
Montgomery, Alabama (C)	121	274	515	843	914	1284	1884
Nantucket, Massachusetts (A)	798	877	1026	2609	2686	2938	5957
Nashville, Tennessee (A)	509	571	812	1851	1899	2175	3507
New Haven, Connecticut (A)	891	911	1110	2845	2809	3219	5895
New Orleans, Louisiana (C)	48	183	332	416	599	735	1024
New York, N. Y. (C)	697	807	1028	2192	2312	2884	5274***
Nome, Alaska† (A)	1849	1928	1857	4618	5770	5236	14580
Norfolk, Virginia (C)	351	472	738	1314	1425	1933	3350
North Head, Washington (C)	968	927	725	2658	2892	2510	5452**
North Platte, Nebraska (A)	1429	1656	1300	3760	4149	3786	6366
Oakland, California (A)	642	726	527	1716	1959	1626	3143**
Oklahoma City, Oklahoma (C)	831	1069	865	2050	2339	2244	3613
Omaha, Nebraska (A)	1440	1483	1355	3536	3774	3639	6131
Oswego, New York (C)	1005	1109	1277	3288	3272	3771	7088
Parkersburg, W. Virginia (C)	652	735	992	2352	2482	2822	4775
Peoria, Illinois (A)	1105	1191	1283	3205	3332	3606	6109
Philadelphia, Pennsylvania (C)	642	760	962	2100	2225	2661	4737***
Phoenix, Arizona (C)	418	630	409	883	1293	990	1405
Pittsburgh, Pennsylvania (C)	692	771	1054	2466	2550	3003	5235
Pocatello, Idaho (A)	1314	1866	1218	3998	4813	3867	6655
Portland, Maine (A)	1176	1188	1321	3777	3640	3926	7218
Portland, Oregon (C)	1097	1066	806	2651	2882	2530	4469
Providence, Rhode Island (C)	847	889	1116	2689	2650	3246	6015
Pueblo, Colorado (A)	985	1382	1060	2968	3661	3224	5514
Raleigh, North Carolina (C)	359	460	722	1426	1515	1975	3234
Rapid City, South Dakota (A)	1736	1739	1320	4374	4489	4021	7118
Reading, Pennsylvania (C)	732	817	1088	2449	2535	3102	5389
Red Bluff, California (A)	821	793	(a)	1783	1947	(a)	(a)
Reno, Nevada (A)	1102	1576	1042	3431	4158	3326	5892
Richmond, Virginia (C)	452	577	831	1686	1833	2211	3695
Rochester, New York (A)	978	1077	1252	3350	3302	3666	6732
Roseburg, Oregon (C)	901	1018	744	2516	2886	2485	4428
Roswell, New Mexico (A)	607	1139	786	2057	2645	2296	3484
Sacramento, California (C)	660	792	614	1661	1934	1610	2653
St. Joseph, Missouri (A)	1204	1306	1187	3084	3287	3147	5161
St. Louis, Missouri (C)	829	966	1060	2295	2539	2798	4585
Salt Lake City, Utah (A)	1184	1659	1110	3463	4248	3259	5555
San Antonio, Texas (A)	246	580	381	687	1160	854	1202
San Diego, California (A)	395	532	332	849	1093	819	1645
Sandusky, Ohio (C)	858	929	1181	2771	2908	3323	6208
San Francisco, California (C)	553	632	465	1486	1734	1414	3264**
Sault Ste. Marie, Michigan (A)	1530	1447	1581	4771	4390	4828	9285**
Savannah, Georgia (A)	108	199	409	695	644	1007	1490
Scranton, Pennsylvania (C)	841	968	1172	2982	3033	3446	6129
Seattle, Washington (C)	1117	975	781	2789	2955	2650	4934**
Sheridan, Wyoming (A)	1775	1790	1431	4628	4773	4629	8008
Shreveport, Louisana (A)	311	536	555	1070	1333	1324	1938
Sioux City, Iowa (A)	1628	1606	1435	4066	4305	4018	6898
Spokane, Washington (A)	1735	1751	1172	4402	4792	3755	6355
Springfield, Illinois (C)	965	1073	1181	2713	2898	3183	5373
Springfield, Missouri (A)	855	1025	973	2529	2732	2647	4428
Syracuse, New York (A)	980	1096	1277	3304	3329	3768	6893
Tacoma, Washington (C)	1128	1024	812	2949	3173	2763	5181**
Terre Haute, Indiana (A)	845	956	1070	2742	2901	2910	4872
Toledo, Ohio (A)	959	999	1203	3167	3207	3392	6077
Topeka, Kansas (C)	1133	1265	1135	2827	3029	3018	4969
Trenton, New Jersey (C)	697	796	1014	2394	2448	2774	4933
Utica, New York (O)	1094	1099	1248	3443	3200	3785	6796
Valentine, Nebraska (C)	1622	1751	1370	4193	4500	4095	7039
Walla Walla, Washington (C)	1468	1476	989	3309	3663	2898	4808
Washington, D. C. (C)	513	674	970	1904	2131	2711	4626
Wichita, Kansas (A)	1065	1280	1094	2629	2985	2877	4673
Williston, North Dakota (C)	2398	1982	1805	5935	5400	5463	9323
Winnemucca, Nevada (C)	1189	1734	1150	3726	4428	3739	6427**
Yakima, Washington (A)	1625	1564	1159	3913	4318	3587	5599

(a) Data not available.
†Nome data are for December.

*Includes August.
**Includes July and August.
***New 48-year normal covering 1898 to 1946.

[1]Figures in this column are normal totals for a complete heating season, September to June, incl.

This is *not* a callback!

It's a happier day for your men (and more profitable for you) when they spend their working hours on *new* installations.

There are days and days like that in the life of the heating and ventilating contractor who depends upon Bryant equipment. His customers, singing the praises of heating and water heating installations that never let them down, have no cause to phone for servicemen.

Take a good look at some of his other advantages, too. A single source of supply for all types of quality gas heating equipment for every industrial, commercial or housing project. A near-by distributor who offers prompt deliveries and helpful engineering service. A brand name known and quickly approved in his specifications.

Perhaps *you* have had the urge to check into the possibilities of Bryant equipment on those important jobs coming up. We're always at your service. Just say the word.

Let the pup be furnace man ...and water boy, too!

bryant

AUTOMATIC HEATING

The most complete line of gas heating equipment in the nation

Bryant Heater, Dept. 141,
17825 St. Clair, Cleveland, Ohio

( ) Send me the new booklet that tells the Bryant story. ( ) Have your distributor call on me.

Name_____

Company_____

Address_____

City_____ State_____

Abstracts AND Reviews

Publications abstracted in this department should be ordered direct from publisher.

OIL BURNERS

A new edition of Oil Burners, by Kalman Steiner, is now available, designed to present information of value to the designer, installer and service man interested in fuel oil, oil burners and oil burning.

The text of the first edition has been rewritten and new material has been added so that the subject matter would include the changes that took place during the thirteen-year interval between the first and second editions.

An elementary discussion of electronics is presented as background for the application of electronics to controls. Sections that are new or which contain a large amount of new material are those dealing with capacities of boilers and warm air furnaces, refractories, draft and combustion control, control of heating systems, and fluid flow.

The author covers both underlying theory and engineering, as well as practical data regarding design, production, installation, operation and maintenance of domestic, commercial and industrial oil burners.

Subjects covered include fuel oils, burners, fans and electric motors, control devices and systems, ignition methods, fuel oil pumps, draft and combustion control, refractories, oil storage tanks and gages, service and maintenance, control of heating systems.

Oil Burners, by K. Steiner. Cloth bound, 6 x 9 inches, 502 pages. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, N. Y. Price, $6.50.

AIR CONDITIONING AND REFRIGERATION

Air Conditioning and Refrigeration, by Burgess Jennings and Samuel R. Lewis, a source and textbook which has gone through two editions and a number of printings, has been materially revised to keep up with the progress and developments in the field that have taken place since the first edition appeared in 1939.

Prof. Jennings is professor and chairman, Department of Mechanical Engineering, The Technological Institute, Northwestern University, and Mr. Lewis is a well-known consulting engineer with offices in Chicago, Ill.

There has been a thorough revision of the heating and ventilating portions of the text as it appeared in an earlier edition. Newly developed psychrometric charts and psychrometric data are used. In addition, extended treatment has been given to radiant heating and the heat pump.

The chapters on warm air and steam heating have been rewritten, and the one on boilers and combustion equipment has been expanded, with additional data on fuels, combustion and control. The refrigeration tables have been amplified.

The book has been developed with the thought that the users already have some previous training in elementary thermodynamics and the principles of engineering. The text is well arranged with extensive use of illustrative examples to show how to use the data.

The engineer and the student should find this book a source of valuable information and a reference volume that should prove helpful.

Air Conditioning and Refrigeration, by B. Jennings and S. R. Lewis. Cloth bound, 6 x 9 inches, 606 pages. Published by the International Textbook Co., Scranton, Pa. Price $6.50.

HEAT PUMP APPLICATIONS

Long interested in the subject of the heat pump, Emory N. Kemler, associate director, Southwest Research Institute, and Sabert Oglesby, Jr., instructor in electrical engineering, Purdue University, have written a book in nontechnical language on Heat Pump Applications. It covers industrial, residential and commercial applications in both this country and in Europe.

From a general discussion of heat pump cycles and thermodynamics, the text covers the specific parts or equipment that is used in a heat pump assembly. It covers in detail such items as compressors, heat exchangers, ducts and fans, electric motors and accessories. Temperature and design data have been included, and information given concerning heating and cooling requirements.

One chapter is devoted to a patent survey which describes and illustrates the recent heat pump design patents that were granted by the U. S. Patent Office.

Other than chapters devoted to heat pump applications, some of the 15 chapters cover thermodynamics of refrigerants and cycles; heat pump cycles; heat sources; and storage and hot water units.

Heat Pump Applications, by E. N. Kemler and S. Oglesby, Jr. Cloth bound, 6 x 9 inches, 300 pages. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, N. Y. Price, $6.

PATENT PRACTICE AND MANAGEMENT

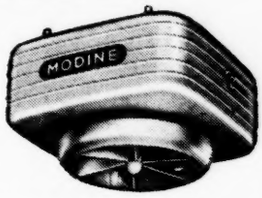
Problems that most frequently concern the inventor and executive are emphasized in Patent Practice and Management, by Robert Calvert, patent attorney of New York City. The author has tried to achieve the goal of presenting the subject matter in the personal manner of the patent attorney sitting across the table from his client. The law is set forth in some detail as a tool for forming judgment in patent matters, and not as an end in itself.

It is intended that this book should be helpful to the inventor, the research director, and the executive. It covers a wide scope and presents not only the essentials of patent law but contains a large amount of practical information.

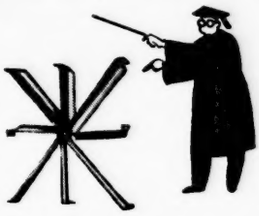
Here's what to look for in Unit Heaters

DISCHARGE AIR TEMPERATURE*

Midgets can't freeze . . . tall men won't melt in buildings heated by Modine Unit Heaters. Here's why, Modine's *right* combination of correct outlet temperature and sufficient air velocity heats *all* parts of a room uniformly, even in coldest weather.



Built-in adjustable radial deflector on vertical models lets you beam, flood or gently diffuse heat, at no extra cost.



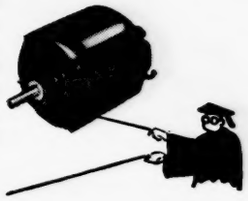
Built-in velocity generator increases heat throw, lets most of warm outlet air disperse cold air near floor without increasing power needs.

**For maximum comfort and lowest operating cost, temperature of air leaving unit heater should be between 110°-120° F. at standard conditions.*

LOWER COSTS

Fuel bills are smaller when you heat with Modine Unit Heaters. Their sufficient air velocity and correctly related outlet temperatures combine to deliver heat down into comfort zones, don't waste it on ceilings.

High quality totally enclosed split-phase or capacitor motors (instead of less expensive shaded-pole type) are used on all but the smallest Modine Unit Heaters. *This means lower power and motor maintenance costs.*



Direct-from-pipe suspension is safe and practical with Modine horizontal models. *This cuts installation costs,* permits easy heat redirection over 360° range.

LONGER LIFE

Modines last longer! Entire condenser of pure copper and copper alloy gives you maximum resistance to corrosion. Tubes are red brass; fins and headers, copper. Parker-Bonderizing protects casings and sheet metal parts against rust formation.

Differential expansion stresses are safely absorbed in individual tubes . . . not transmitted to tube header joints to cause condenser fracture. Fins are permanently bonded to tubes. All condenser joints are brazed . . . no screwed or expanded joints to weaken condenser structure.

Modine
UNIT HEATERS

Yes, look beyond BTUs when buying Unit Heaters. Look to Modine! You can get all the facts by calling your nearest Modine Representative. He's listed in the classified section of your phone book. Or write direct. Modine Mfg. Co., 1511 Dekoven Ave., Racine, Wis.

Ask for the new Modine Unit Heater Bulletin 149A. Also available on special request is the informative booklet — "How to Evaluate Unit Heater Performance Characteristics." Send for them today!

U-1032

The text, which is divided into 30 chapters, covers such subjects as what to patent; patentable and unpatentable classes of subjects; special incentives for inventors and executives; patent rights of employers and employees; writing the application; patent office procedure; establishing date of invention and keeping research records; license of patents; utilization of patents without license, sale or suit; claim interpretation; infringement; measure of liability for patent infringement; tax law of research, invention and patents; and foreign patents.

Patent Practice and Management, by R. Calvert. Cloth bound, 6 x 9 inches, 371 pages. Published by Scarsdale Press, Box 536, Scarsdale, N. Y. Price, $5.

ELECTRIC ARC WELDING

In its new book, Electric Arc Welding, the Hobart Trade School has made available a comprehensive and practical textbook on the procedure and practice of arc welding.

The 28 chapters are divided in 5 parts as follows:

Part 1 discusses the development of electric arc welding, describes applications, available metals and alloys, joints and welds, electrodes, equipment and other basic procedures.

Part 2 constitutes a complete self-study course, incorporating review summaries, practical exercises and quiz questions.

Part 3 describes in detail the principles and practical operations of carbon arc welding.

Part 4 covers other welding processes such as inert-gas-shielded arc welding, submerged arc welding, and electric stud welding.

Part 5 presents the welding terms and their definitions of the American Welding Society.

Electric Arc Welding. Cloth bound, 5¼ x 8 inches, 544 pages. Published by Hobart Trade School, Troy, Ohio. Price, $3.

• • •

CONDENSATION CONTROL—Information on Condensation Control in Dwelling Construction is presented by the Housing and Home Finance Agency to show how to control condensation by means of vapor barriers and proper ventilation. Methods illustrated in booklet are based on studies by the Forest Products Laboratory and the Housing and Home Finance Agency and on observations made over many years of buildings involved in moisture problems. Paper bound booklet contains 73 pages and 57 illustrations. Price, 20 cents. Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

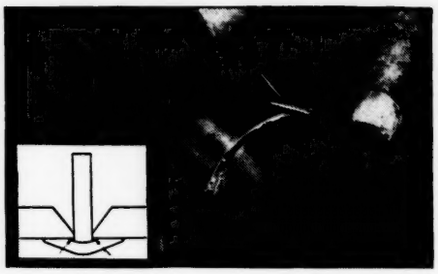
BOILERS—In pamphlet R157-50 is presented simplified practice recommendations for steel firebox boilers and steel heating boilers. Revisions described were proposed by the Engineering Committee of the Steel Boiler Institute and have been approved for promulgation by the industry. Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Price, 10 cents.

HOW

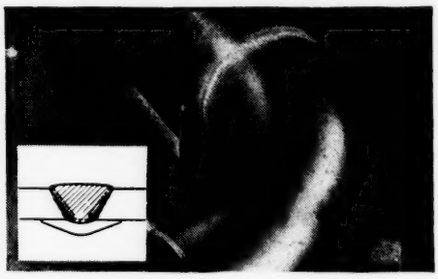
TO WELD PIPE FASTER AND BETTER

● The *only* completely engineered welding rings—Tube-Turn groove type rings with knock-off spacer pins—are the answer. They permit fast assembly with exact joint spacing and complete weld penetration. They're easy to use . . . save time.

Ring snaps easily into place. Knock-off spacer pins space and center the pipe accurately and automatically.



Tacking completed, spacer pins are knocked off and the welder finishes his joint. Insert shows cross-section of ring and joint.



The finished job . . . a perfectly welded joint. Irregular black area (see insert) indicates greater width of fusion zone obtained with Tube-Turn welding ring.

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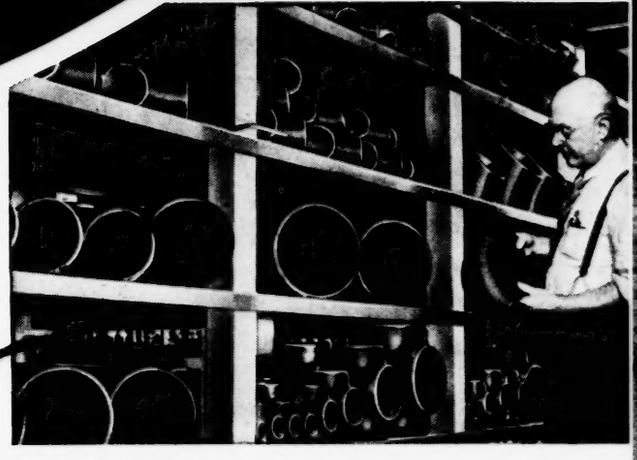
TUBE-TURN



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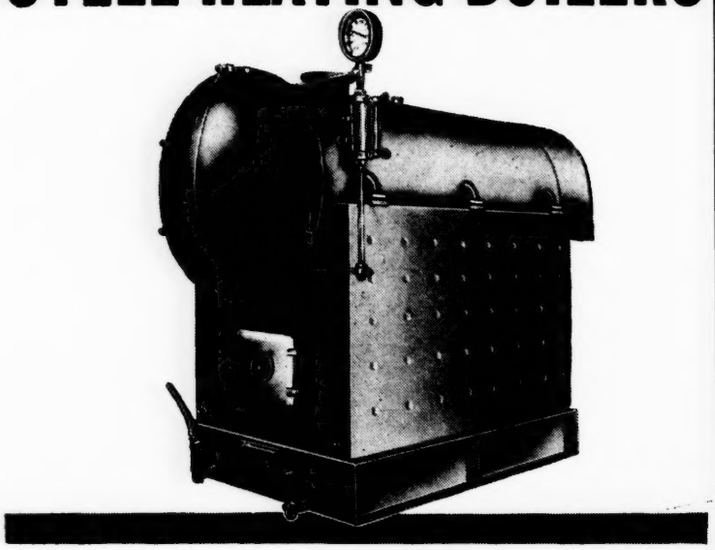
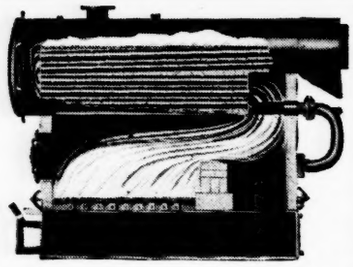
Compact All Welded

HIGH FIREBOX

STEEL HEATING BOILERS

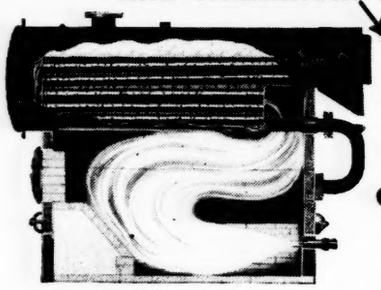




Cutaway view to show Type CC Compact Boiler (hand fired)

1. Large Grate Area
2. Large Furnace Volume
3. Large Disengaging Area
4. Large Steam Volume
5. Long Heat Travel

These Features Assure More Savings in Fuel and Maximum Heat Output



1. Long Flame Travel
2. Max. Furnace Volume
3. Reasonable Heat Release
4. Highest Efficiency
5. Longest Life

Cutaway view to show Type CM Compact Boiler (mechanically fired)

Write for complete informative Bulletin B-3000B for CM & CC Types

Titusville manufactures a Complete Line of High and Low Pressure Fire and Water-tube Boilers to meet all capacity and pressure requirements. *Request bulletin "Meet the Titusville Family."*

TITUSVILLE IRON WORKS CO. TITUSVILLE, PA.

division of Strathers Wells

THE TITUSVILLE IRON WORKS CO.

TITUSVILLE, PENNA.

Representatives in Principal Cities

Getting Personal

J. K. Campbell

James K. Campbell (*Heating and Ventilating a Bus Garage and Repair Shops*, page 54) has been a member of the consulting engineering firm of Eadie, Freund and Campbell since its establishment over 35 years ago. Following his graduation from Woodberry Forest School in Virginia, he attended M.I.T. where he received a Bachelor of Science degree in Civil Engineering.

After graduation he worked as engineer on the valuation of the New York Central Lines and later on the Lehigh Valley Railroad. The next valuation job offer was turned down, however, in favor of an industrial engineering job with a New England shoe manufacturer. The routine of small town shoe factories was soon exchanged for more interesting work in a New York consulting engineering office where he not only gained valuable experience but also met his present partners, John G. Eadie, M.E., and Mortimer Freund, E.E.

The firm's practice has covered all branches of engineering work relating to industrial plants as well as housing projects, hotels, commercial, institutional and other types of buildings.

Mr. Campbell is a member of Beta Theta Pi, the American Society of Civil Engineers and the New York State and National Societies of Professional Engineers. He is also a member and past president of the New York Association of Consulting Engineers.

A. E. Tiesler

A. E. Tiesler (*Air Conditioning in the Production of Pharmaceutical Products*, page 63), is superintendent of pharmaceutical manufacturing at the main plant of the Lederle Laboratories Division, American Cyanamid Co., Pearl River, N. Y.

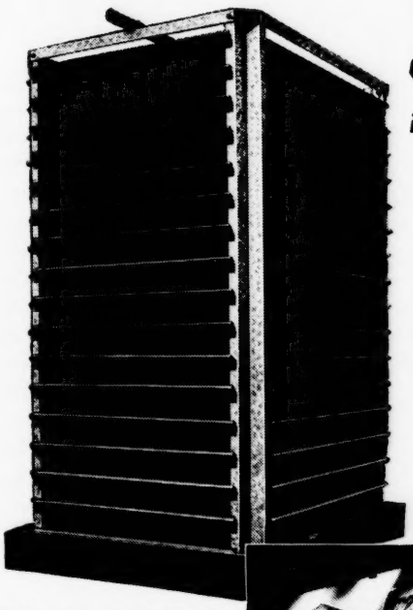
In his fifteen years with Lederle, Mr. Tiesler has been instrumental in the development of many techniques of manufacture now considered standard throughout the industry. He was a member of the research team that pioneered the commercial production of concentrated liver extract, which is so vital to the life of sufferers from pernicious anemia.

Mr. Tiesler received the no-longer-awarded degree of Pharmaceutical Chemist from Columbia University in 1928, and also holds a Bachelor of Chemistry degree from Cornell University. He is a member of the American Chemical Society, American Pharmaceutical Association, American Pharmaceutical Manufacturers Association, and the American Drug Manufacturers Association.

. . . Since the Last Issue

Philip Carey Mfg. Co., Cincinnati, Ohio, has announced that **Martin V. Coffey**, formerly sales manager of the company's Miami-Cabinet Division, has been appointed general sales manager.

Appointment of **Eric H. Ryden** as gas heating project engineer was recently announced by the **Timken Silent Automatic Division**, Jackson, Mich.



SLASH your cooling water cost

install a **Binks** *natural draft cooling tower*

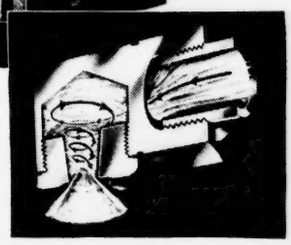
You can cut your cooling water bill to almost nothing by installing a Binks Type "S" Natural Draft Cooling Tower. This type of tower is excellent where air movement is unrestricted*. You recirculate the same water over and over, passing it through the cooling tower each time. A small pumping cost replaces high water bills.

Binks Type "S" Cooling Towers are made in a variety of types and sizes, handling from 15 to 1200 gallons per minute with high efficiency. These towers will provide you with many years of trouble-free service.

ideal for many applications

Binks Type "S" Cooling Towers are the accepted standard for cooling condenser circulating water from refrigeration and air conditioning compressors...for cooling water-jacketed engines...or for low-cost cooling in many manufacturing processes where heat is dissipated by spraying water or other fluids.

**Ask about Binks Mechanical Draft Towers for locations where air movement is limited.*



Binks clog-proof Rotojet spray nozzles contribute much to the high efficiency of Binks towers. Their side-inlet, whirl-chamber design and precision manufacture assure maximum fluid break-up and long life.

Send today for FREE Bulletins

which give full information about Binks Type "S" Towers:

Bulletin 30—Single section towers
Bulletin 31—Multiple section towers
Bulletin 32—Large capacity towers
Bulletin 40—All Redwood towers

Please state how tower will be used, also capacity required.

THERE'S A BINKS TOWER FOR EVERY COOLING JOB

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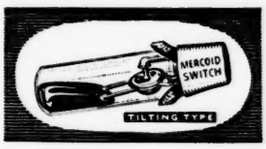
MERCOID

AUTOMATIC CONTROLS FOR HEATING, AIR CONDITIONING, REFRIGERATION AND VARIOUS INDUSTRIAL APPLICATIONS



THE ONLY 100% MERCURY SWITCH EQUIPPED CONTROLS

The distinguishing feature of Mercoid Controls is the exclusive use of Mercoid hermetically sealed mercury switches These switches are not subject to dust, dirt or corrosion, thereby assuring better performance and longer control life. The items shown below are but a few miscellaneous items. See Catalog No. 700 for the complete line.

Pressure Controls

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Low Voltage Thermostats

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Oil Burner Safety and Ignition Controls

If you have a problem involving the automatic control of pressure, temperature, liquid level, mechanical operations, etc., it will pay you to consult Mercoid's engineering staff — always at your service.

Manufacturers of Dependable Automatic Controls for Over A Quarter of A Century

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FREON SHELL AND TUBE CONDENSERS
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HEAT EXCHANGERS **OIL SEPARATORS**
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BLO-COLD INDUSTRIAL UNIT COOLERS
PIPE AND FIN COILS **AMMONIA CONDENSERS**

**A new Acme product with outstanding features. Write for Catalog No. 40.*

Write for free catalog on any of the above items

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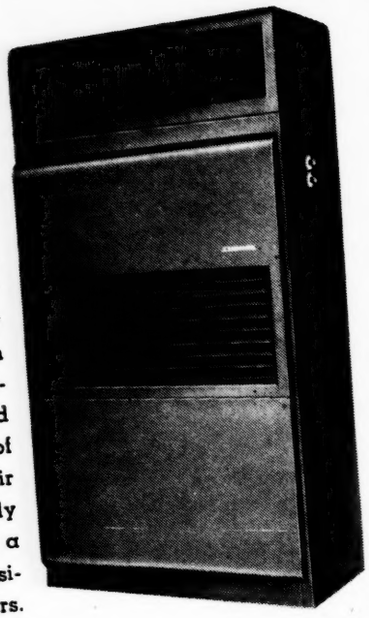
Blueprinted the Major Post-War Changes

in AIR CONDITIONING

From the drafting boards of Typhoon engineers came most important advances in post-war air conditioning... trail-blazing "firsts" that set a new trend, started a wave of re-designing throughout the industry. The major improvements pioneered by Typhoon have been fully proven in action — through topnotch performance in actual installations the world over. Typhoon...product of more than 40 years of air cooling experience...solidly engineered to help build a solid air conditioning business for Typhoon dealers.



COMPLETE LINE OF PACKAGED

AIR CONDITIONERS

1½ to 20 Tons

and Evaporative Condensers

3 to 20 Tons

Our District Sales Managers are ready to bring you complete information—write today for prompt action.

TYPHOON AIR CONDITIONING CO., INC.

794 Union Street • Brooklyn, N. Y.

Richard E. Lawton, assistant manager of the New York office of **Warren Webster & Co.,** Camden, N. J., died on January 3rd, at the Newport Hospital, Newport, Rhode Island, at the age of 50. He had only recently returned to his post in September after recuperating from operations for cataracts. His death was attributed to Bright's disease. Mr. Lawton joined Warren Webster & Company in April, 1924, and had recently completed 25 years of service with the company in the New York office with the exception of a short period of time during which he was loaned to handle the Columbus, Ohio, office.

R. E. Cassatt

Robert E. Cassatt has resigned his position as assistant advertising and sales promotion manager of General Electric, receiver division, Syracuse, New York, to become advertising manager of **Fedders-Quigan Corp.,** Buffalo, manufacturer of air conditioning, heating and refrigeration equipment. Mr. Cassatt attended the University of Pennsylvania, and was associated with advertising agencies in New York and Syracuse before joining General Electric, where he was responsible for the preparation of advertising and sales promotion material for radio, television, and replacement parts. During the war he was engaged in the coordination of production and procurement of material for Army, Navy, and Signal Corps at General Electric.

Lorin G. Miller, dean of the College of Engineering of Michigan State College, has been appointed engineering consultant by **United States Radiator Corp.**

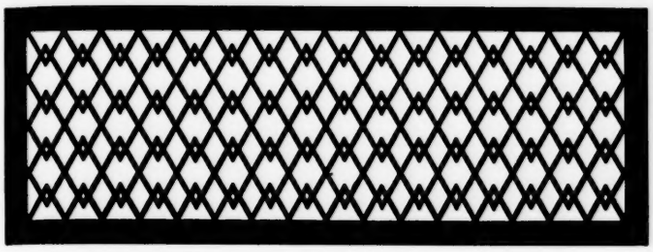
J. Howard Smart, sales manager of **Tuttle & Bailey, Inc.,** New Britain, Conn., was elected president of the **Convector Manufacturers Association** at the annual meeting in the Hotel Cleveland, Cleveland, Ohio, February 14. He succeeds E. A. Cline of the Trane Co., LaCrosse, Wis., who has served for the past two years. **Walter Schlicting,** sales manager of Young Radiator Co., Racine, Wis., was elected secretary of the association.

K. R. Knoblauch has been named manager of sales of valve products for the industrial division of **Minneapolis-Honeywell Regulator Co.** Mr. Knoblauch joined Brown Instruments division of the company in 1924 in engineering work. In 1939 he was made assistant sales manager of the industrial division, the headquarters of which are in Philadelphia. Four years later he was placed in charge of market extension and sales promotion. He will continue to make his headquarters at the Brown plant.

Appointment of **Arthur L. Wales** of Providence, Rhode Island, as field training director of **The Institute of Boiler and Radiator Manufacturers** has been announced. For the last five years Mr. Wales has been a division head of the New England Technical Institute, and previous'y was employed for 16 years with a manufacturer of heating accessories.

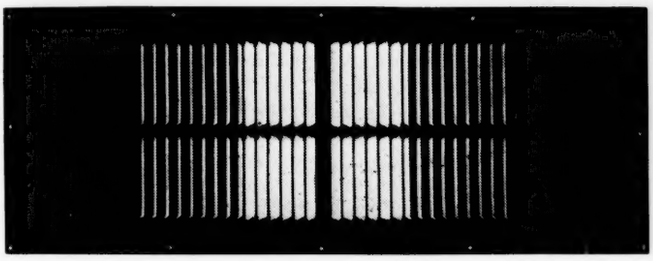
The appointment of **Albert W. Biggs,** a native Toledoan, to the market analysis division of the advertising department of **Surface Combustion Corp.** has been announced.

Hoffman Specialty Co., Indianapolis, Indiana, announces the purchase of Tallmadge zoned controlled heating systems from **Webster Tallmadge & Co., Inc.,** East Orange, New Jersey. Since January 15, 1950, all manufacturing operations, sales, orders and correspondence pertaining to these heating systems have been conducted under the new name of Webster Tallmadge Systems, 1001 York St., Indianapolis 7, Ind. This new division has become part of Hoffman's Engineering Division under the direction of **A. O. Roche, Jr.,** chief engineer. **D. C. Kellogg,** formerly associated with Webster Tallmadge & Co., Inc., has joined the Hoffman Organization as sales engineer of this division.



A Hendrick grille design (M No. 9) suitable for use with deflecting unit in Bulator combination.

The Perfect Combination
of a deflecting unit and ornamental grille



Vertical deflecting vanes, showing how the vanes may be set to produce any desired air stream pattern.

Now you can secure all the advantages of an adjustable deflecting vane grille—*to control air flow*—and an ornamental grille—*to harmonize with the decorative scheme*—by specifying the new dual-unit Hendrick BULATOR.

For this combination of deflecting unit and ornamental grille there's a wide selection of Hendrick ornamental grille designs which have ample open area so the air throw and spread are not appreciably affected.

Mounted just behind the ornamental grille, the deflecting unit is not noticeable, and its vanes are adjustable so that the air flow can be deflected to right or left, up or down, or in a combination of directions.

Write for full information.

SEE OUR CATALOG IN SWEET'S

Perforated Metals
Perforated Metal Screens
Architectural Grilles
Mitco Open Steel Flooring,
"Shur-Site" Treads and
Armorgrids

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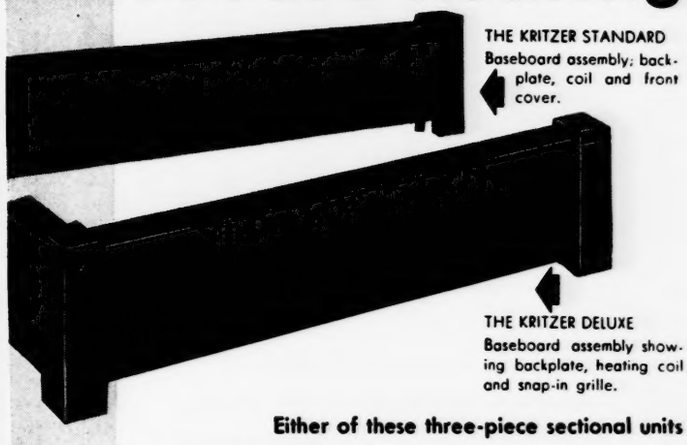
Modern Heating at its best . . . . . but definitely on the economy side!

for less cost and greater sales appeal use

Kritzer
baseboard heating



THE KRITZER STANDARD
Baseboard assembly; backplate, coil and front cover.

THE KRITZER DELUXE
Baseboard assembly showing backplate, heating coil and snap-in grille.

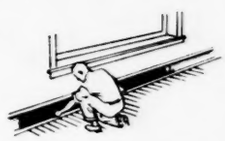
Either of these three-piece sectional units provides the simplest kind of installation . . . cuts labor time in half.

Here are BTU's more efficiently delivered; heat more evenly distributed and rooms with warmer floors.

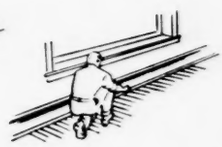
Attractive too; . . . as the component parts are engineered with Kritzer skill to replace in size and design the conventional wooden baseboard.

3 easy steps take care of the installation work.

1 Back cover plate with integral hangers for coil is attached.



2 Coil is hung and connected . . in sections with solder ring . no fittings.



3 Front cover plate is snapped on and you're finished.

IF IT'S KRITZER IT'S RIGHT SIR

. . . so get the facts right away. Send this coupon for ratings, construction data and the remarkably simple installation details.

KRITZER RADIANT COILS, INC.
2907 W. Lawrence Ave., Chicago 25, Ill.

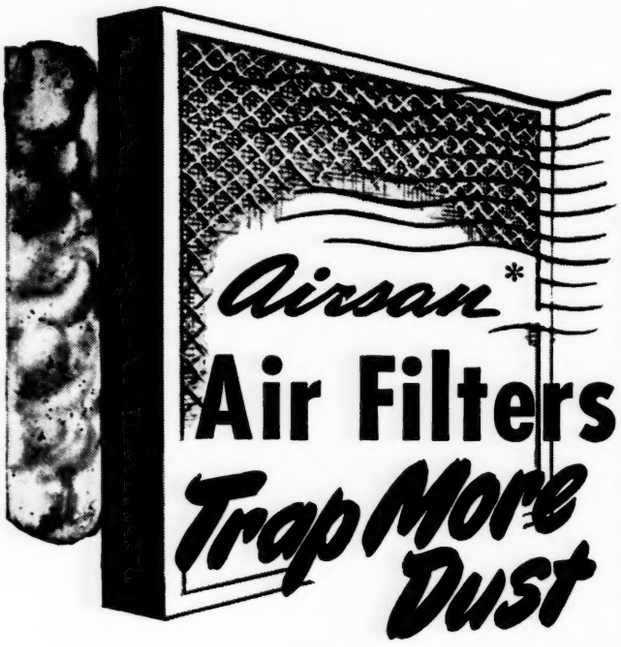
Gentlemen: I'm interested. Please send complete information and bulletin on Kritzer Standard and Deluxe Baseboard Heating.

Name.....

Firm.....

Address.....

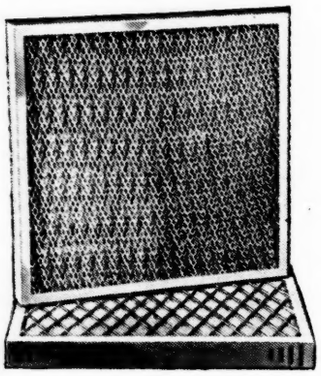
City..... Zone..... State.....



Airsan*

Air Filters Trap More Dust

For Air Conditioning, Heating and Ventilating



Greater efficiency — lower resistance is yours with an AIRSAN Air Filter.

A permanent, cleanable viscous type filter of all galvanized construction, having full bronze welded corners. Expanded metal face plate acts as lint arrestor to provide easier cleaning and servicing. Rated filtering efficiency 98.5%. In standard 1" and 2" thickness.

Also available for heavy duty service on industrial and special applications — in 2" to 4" thickness. Holding frames (for V-type or straight banks) are made for all type filters.

SEND FOR BULLETINS →

* FORMERLY AIRCOR

AIR FILTER CORPORATION

108 H NORTH WATER STREET MILWAUKEE 2, WIS.

A Few Distributorships Available. Write for Details.

Canadian Representative: DOUGLAS ENGINEERING CO., Ltd. Montreal

Airsan

The appointment of **George C. Jelliffe** as eastern district manager for the **Ilg Electric Ventilating Co.** of Chicago is announced. Headquarters for the Eastern District are at 15 Park Row, in New York City.

James H. Binger has been elected vice president and general manager of the Belfield Valve Division (Philadelphia) of **Minneapolis-Honeywell Regulator Co.** A native of St. Paul and a 1941 graduate of the University of Minnesota law school, Mr. Binger joined Honeywell in 1943 as administrative assistant in the aeronautical division, and in December of 1945 was elected assistant secretary of the company. Two years later he was made assistant vice president and was transferred to the sales department, a position he held until his latest promotion.

The St. Louis branch of **Minneapolis-Honeywell Regulator Co.** and its Brown Instruments Division has moved into its new office building. The new structure, the first to be built and owned by the company, contains about 6,600 sq ft of floor space at 4354 Oliver St.

W. W. Dillon

Hoffman Specialty Co., Indianapolis, announces the promotion of **Woody W. Dillon** to the position of sales manager. Mr. Dillon has been with the company for 20 years, most recently serving as assistant sales manager. He has also handled Hoffman trade and national advertising, managed sales promotion activities, directed displays at national trade shows and will continue to do so in his new capacity. He steps into his new responsibilities with a well worked out program for substantially increasing Hoffman sales throughout 1950. As Hoffman sales manager Mr. Dillon succeeds Ed. L. Malm, who has resigned to take up new duties with U. S. Radiator Corporation.

Taylor Forge & Pipe Works, Chicago, has announced the formation of Taylor Forge & Pipe Works of Canada, Ltd. This new subsidiary will be located at Hamilton, Ontario, and will augment the productive capacity of the company which now has plants at Chicago, Ill., Carnegie, Pa., and Fontana, Calif.

Guy A. Baker has been appointed vice president in charge of manufacturing, for the **Duriron Co., Inc.**, of Dayton, Ohio. For several years Mr. Baker has been assistant to the president and secretary of the company. **R. Merton Shields** has been appointed secretary of the Duriron Co. Mr. Shields, prior to his new appointment, was manager of the Dayton district sales for Duriron.

The Insulation Division of **The Eagle-Picher Sales Co.**, has announced the resignation of Douglas Via as sales manager of the Industrial insulation department of the company. At the same time, the appointment of **Walter D. Myers, Jr.**, to succeed Mr. Via, was announced. Mr. Myers has been with The Eagle-Picher Co. for five years. He was formerly a sales representative for the Pittsburgh area and, more recently, was in charge of Industrial insulation sales in the New York market.

An expansion of the administrative staff of **United States Air Conditioning Corp.**, manufacturers and engineers of air conditioning, ventilating and heating equipment, has been announced. **James R. Logan** has been appointed vice president in charge of manufacturing and engineering, and **Merrill L. Benson** has been named manager of the coils and coil products division. Mr. Logan has been associated with General Electric, General Mills, and Allied Control Valve since his start in the manufacturing industry in 1929. Mr. Benson has spent more than 27 years with such well-known coil producers as Trane, McQuay, and American Blower.

LEE DIRECT WARM AIR HEATING

Higher Efficiency! Greater Economy!

Direct warm air heating is fundamentally the most efficient means of transferring heat from fuel to air, and is especially suited to the heating of industrial buildings of all types, hangars, etc. Lee Engineering Company was one of the pioneers in this field, and today offers a complete line of both central system heaters and unit heaters. The Lee system gives heat WHEN needed and WHERE needed. It begins to distribute heat immediately after fire is lighted and fan started, responds promptly without lag. Air-flow is counter-current to flow of combustion gases, so that air becomes warmer as it extracts heat from the progressively hotter gases. Lower installation cost than steam or hot water; requires no licensed attendant; provides ventilation without additional cost. No expensive installation or maintenance of pipes, traps, valves, and pumps. Used with oil or gas, also with coal (stoker or hand-fired). Four main types illustrated here—send for Bulletin 10 with complete facts.

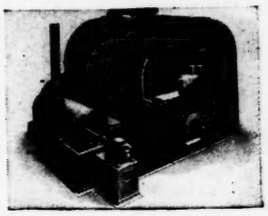
BRICK-SET TUBULAR HEATER

For use with central heating system (with duct distribution). Single heater capacities, 2,800,000 to 8,000,000 Btu per hour. Battery of two, operating as unit, provide over 10,000,000 Btu per hour.

Brick Set Tubular Heater

STEEL ENCASED TUBULAR HEATER

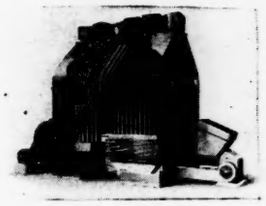
For use with central heating system (with duct distribution). Capacity range, 2,000,000 to 6,000,000 Btu per hour. May be installed in heated area without enclosure, requires no foundation. Unit may be moved by taking apart and reassembling.



Steel Encased Tubular Heater

TUBULAR UNIT HEATER

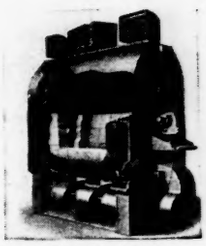
For use as central system (with duct distribution) or as unit heater, with adjustable outlet nozzles. Capacity range, 2,000,000 to 6,000 000 Btu per hour. In sizes up to 4,000,000 Btu, shipped completely assembled with all but mechanical equipment, refractory lining and controls in place. Requires no foundation. Equipped with crane hooks for moving.



Tubular Unit Heater

SHELL UNIT HEATER

For use with or without distributing duct system. Capacity range, 300,000 to 2,000,000 Btu per hour. Both hand- and stoker-fired models. All units shipped completely assembled, wired, ready for operation. Units furnished with either refractory lined or stainless steel combustion chambers. Heaters may be floor mounted or suspended in any position.



Shell Unit Heater

LEE ENGINEERING COMPANY

95 RIVER STREET • HOBOKEN, NEW JERSEY

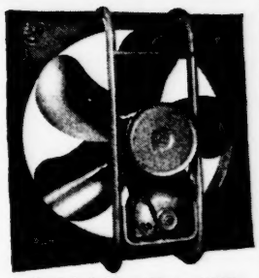
(Formerly Youngstown, Ohio)

—MOST COMPLETE LINE FOR '50!

CHELSEA FANS

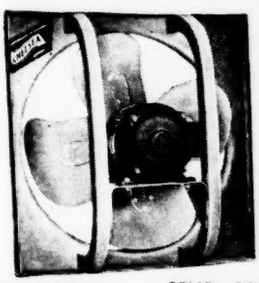
—FOR EVERY INDUSTRIAL AND COMMERCIAL NEED!

There's a CHELSEA fan for every requirement—each type certified for performance in accordance with the Standard Code of the Propeller Fan Manufacturers Association.



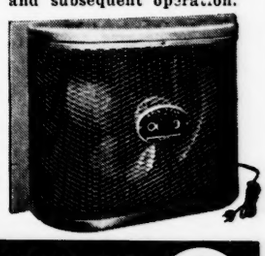
Industrial Fan Type IND
For large general area ventilation. Moves large volumes of air under pressure. Sizes from 24" to 60".

All-Purpose Fan Type BB



For removing smoke, steam, heat, fumes, etc. Heavy duty, direct drive fan for continuous operation. Recommended for use against static pressure and in duct work. One piece panel and orifice, lightweight, simple to install. Sizes from 10" to 30".

Spin-It-Fan;—16" and 22"
A new idea in window fans—reversible for drawing-in or exhausting air. Two speed, for cooling and ventilating, and subsequent operation.



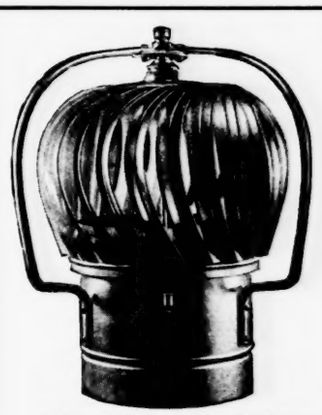
SEND FOR YOUR FREE KIT!
Contains all the information you need to make ventilating installations in factory, store, office or home. Write for yours today—Dept. N.

CHELSEA FAN & BLOWER CO., INC.
1206 GROVE ST., IRVINGTON, N. J.

ALLEN TURBINE VENTILATOR

The pioneer of turbine ventilators, originated by Allen, and now in use in thousands of installations in industry and commerce.

•



Allen Type "C" Turbine Ventilator shown. Allen's famous "Coni-Vane" and Type "A" Armless Turbine Ventilators are also available.

For economical but positive and thorough ventilation, these ventilators will give maximum performance per dollar spent! Ventilator operates on wind power, on sensitive but rugged bearings. Rotors are built up of die-formed blades, in perfect balance and uniformity. Easily lubricated Oilite and hardened alloy steel bearings assure long life. Made of prime sheets of heavy-gauge galvanized iron, spot welded for permanence. Throat diameter, 6 to 48 in. Free air displacement (based on 10 ft. stack height, 20F temp. diff.), 5740 to 267,800 cu. ft. per hr. Write for catalog on complete line of roof ventilators.

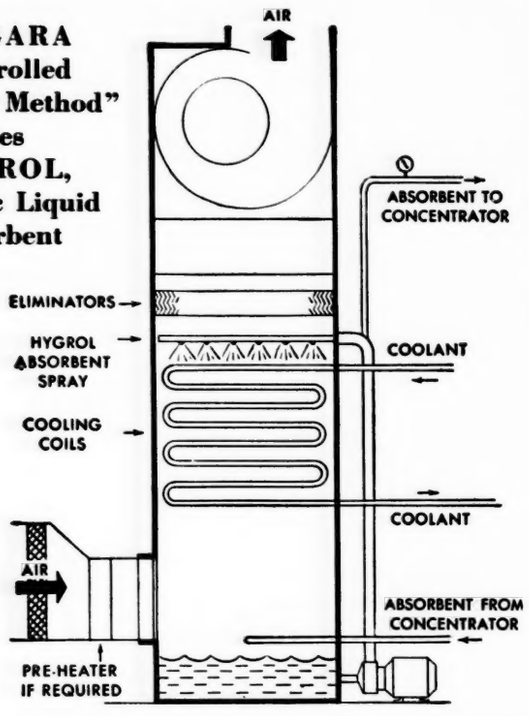
Representatives in most principal cities

SEE OUR CATALOG IN SWEET'S

ALLEN VENTILATOR DIVISION
PRODUCTION PLANNING COMPANY
Rochester, Michigan

New Method Gives Precise Control in Air Conditioning

NIAGARA "Controlled Humidity Method" Uses HYGROL, Hygienic Liquid Absorbent



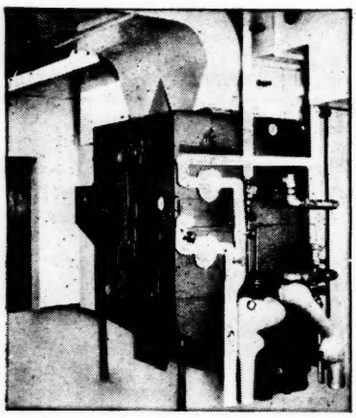
NIAGARA CONTROLLED HUMIDITY METHOD — FLOW DIAGRAM

● The "Niagara Controlled Humidity Method" gives complete control of temperature and relative humidity, holding constant conditions or varying them at the will of the user. Especially, it provides dry air at normal atmospheric temperatures with little or no refrigeration required.

The air is filtered and then enters a chamber where it is dehumidified in passing thru a spray of "Hygrol" Liquid (a hygienic hygroscopic chemical that absorbs the air-borne moisture and contains no salts or solids to precipitate). In the same chamber are located cooling coils which remove the latent heat of evaporation and also sensible heat as required.

The absorbent liquid spray falls into a tank at the base, where it is piped to a concentrator, removing moisture taken from the air. The re-concentrated liquid returns to the system. This process is continuous, and the apparatus operates at full capacity at all times.

This equipment is manufactured in a range of sizes providing from 1000 to 20,000 CFM of conditioned air from a single unit.



Installations have been made in food and chemical process industries, in packaging hygroscopic products, for preventing condensation of moisture on metals and other products in storage, in air conditioning for laboratory control and for human comfort.

●

For further information, write Niagara Blower Co., Dept. HV, 405 Lexington Ave., New York 17, N. Y.

Peabody Engineering Corp., New York, N. Y., has announced the appointment of **Stephen A. Sloan** as manager of research and development.

Appointment of **Guy C. Stoltz**, veteran air conditioning engineer and sales executive, as Houston dealer branch manager of **Carrier Corp.**, has been announced. Mr. Stoltz has been manager of Carrier's Detroit branch office.

Wolverine Tube Division of the Calumet & Hecla Consolidated Copper Co. has established a new sales office in Room 703, Eighty-One Madison Building, Memphis, Tennessee. **M. J. Cook**, Wolverine representative, will headquarter in the new office.

General Controls, Glendale, Calif., manufacturers of automatic pressure, temperature, level, and flow controls, has announced the opening of the company's 22nd branch office at 721 South Orange Ave., Newark 6, N. J. The new office will include extensive warehouse facilities. **William Buck**, formerly sales engineer for the company's Philadelphia branch, has been named as Newark branch manager. Other General Controls organizational changes include the appointment of **R. M. Korty** as branch manager in St. Louis, Mo.; the addition of **Robert L. Day** to the sales engineering staff in San Francisco, and the appointment of **Rudolph J. Roedder**, sales engineer, as refrigeration specialist in the Los Angeles sales office.

The appointment of **Ross Roy, Inc.**, Detroit national advertising agency, to hande all Norge heat advertising, merchandising, sales promotion, and sales training, has been announced by **Norge Heat Division, Borg-Warner Corp.** M. A. Straub, assistant sales manager, has been placed in charge of sales promotion and advertising activities for the division.

Jchn S. Mackinlay has been appointed manager of product service of the **Air Conditioning Department, General Electric Co.** Mr. Mackinlay joined General Electric in November 1949. He was formerly associated with the Penn Electric Switch Co., McGray Refrigerator Co., and Jack & Heintz Co.

The Ventilator Division of **The Swartwout Co.**, Cleveland, now shares the company's New York City branch office at 103 Park Avenue with the company's steam specialties division.

Frederic Alan Schaff, chairman of the board of **Combustion Engineering—Superheater, Inc.**, died at his home, 27 Masterton Road, Bronxville, New York, February 7, at the age of 65, following a protracted illness.

INDUSTRIAL DEGREE-DAYS
January, 1950

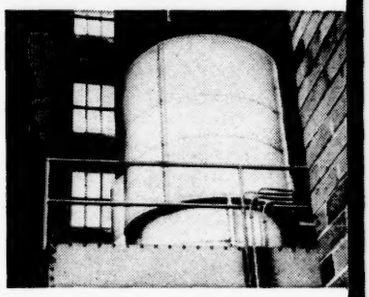
City	55F Base	45F Base
Baltimore, Md.	298	101
Buffalo, N. Y.	626	352
Chicago, Ill.	710	413
Cleveland, Ohio	570	300
Detroit, Mich.	693	411
Indianapolis, Ind.	559	302
New York, N. Y.	398	155
Philadelphia, Pa.	355	134
Pittsburgh, Pa.	402	183
St. Louis, Mo.	534	291

Industrial Sound Control

QUIETS

COOLING TOWERS

in Air Conditioning Installations



Ends

- ANNOYANCE
- COMPLAINTS
- THREATS OF LEGAL ACTION

due to disturbing noise

Now your new or existing air-conditioning installations can be made *whisper-quiet*, to comply with every city ordinance. ISC can solve the noise problem quickly, inexpensively. Investigate today.

Write, wire or phone us for full information on your problem

Industrial Sound Control

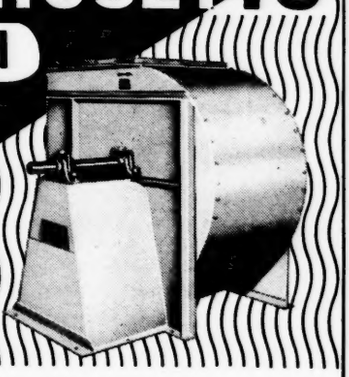
INCORPORATED

45 Granby Street, Hartford, Conn.

2119 Sepulveda Blvd., Los Angeles, Calif.

MASSACHUSETTS

Squirrel Cage and Power Fixed FANS



SQUIRREL CAGE FANS

Fan wheels have low speed characteristics. The low air velocities permitted are conducive to efficient operation. Housings are rugged and compact. Wheel sizes Single Width 13½" to 86½" dia. Double width 18" to 86½" dia.

POWER FIXED FANS

Backward curve blade type with non-overloading characteristics. Housings are constructed of steel plate and reinforced with heavy bracing angles. Wheel sizes Single Width 13½" to 86½" dia. Double Width 18" to 86½" dia. Class I or Class II construction for better fan selection.

Write for catalogs.

MASSACHUSETTS BLOWER DIVISION

The BISHOP & BABCOCK Mfg. Co.

4901 HAMILTON AVENUE CLEVELAND 14, OHIO

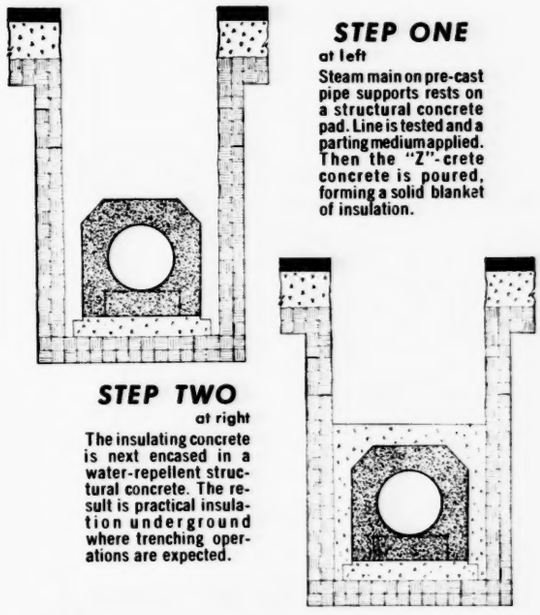
FAST! SIMPLE! ECONOMICAL! EFFICIENT!

ARMORED INSULATING CONDUITS FOR HEAVY TRAFFIC AREAS

USING **"Z"crete**

Cast-in-Place Insulation

The simplest yet most efficient solution to installations where traffic loads exist or where streets are frequently torn up. Ideal for underground installations because it will not disintegrate or deteriorate from wetting, exposure or electrical currents. "Z"-crete is permanent.



STEP ONE

at left

Steam main on pre-cast pipe supports rests on a structural concrete pad. Line is tested and a parting medium applied. Then the "Z"-crete concrete is poured, forming a solid blanket of insulation.

STEP TWO

at right

The insulating concrete is next encased in a water-repellent structural concrete. The result is practical insulation underground where trenching operations are expected.

"Z"-crete Insulating Concrete

Specially graded and mixed for underground insulation of steam, hot water and processed liquids. Furnished and installed by authorized applicators under rigid supervision. Write today for full information.

"Z"-CRETE DIVISION

ZONOLITE COMPANY

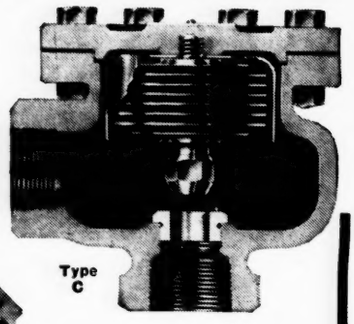
135 S. La Salle St., Dept. HV-30, Chicago 3, Illinois

BEST ALL ROUND FOR YOUR UNDERGROUND!

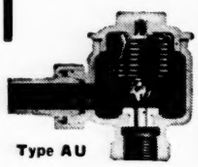
Leading Processor

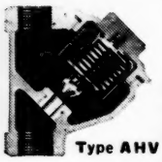
Shortens Operation from 65 to 45 Min.

with Nicholson STEAM TRAPS



Records of a recent installation of Nicholson steam traps, by a large food packer, show they cut cooking time 30%;





e.g., one operation was shortened from 65 to 45 min. Nicholson units keep equipment full of live steam because: 1) they operate on lowest temperature differential; 2) have 2 to 6 times average drainage capacity. Also record low for steam waste; and maximum air-venting capacity. Widely specified for preventing damage to thin gauges of heat transfer units; eliminate cold blow in unit heaters. 5 types for every application; size ¼" to 2"; pressure to 225 pounds.

BULLETIN 1047.

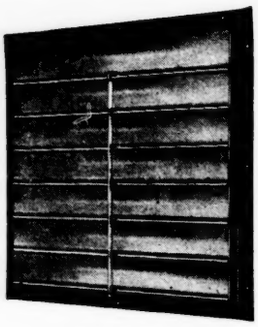
W. H. NICHOLSON & CO. 199 OREGON ST. WILKES-BARRE, PA.

Valves ★ Traps ★ Steam Specialties

Elgo Ventilating Specialties

A Leader In Automatic Shutters

The Elgo Automatic Shutter is the favorite of many large users because of its outstanding features. Easier opening and tighter closing. Louver blades equipped with special felt silencing pads. Sizes from 8" to 72" square —also rectangular.

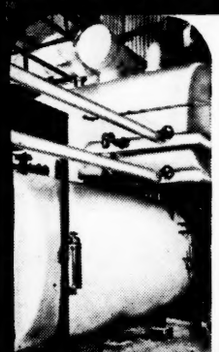


"ELGO" TYPE AUTOMATIC SHUTTER Front View (Closed)

Free CATALOG

ELGO SHUTTER & MANUFACTURING CO.
2738 W. Warren Detroit 8, Mich.

HERE'S YOUR COVER FINISH



No need to sew covers onto insulation. Cementing saves time, costs less. Arabol Lagging Adhesive — developed for war needs — now meets all requirements on installations of all sizes. Easily applied, dries quickly, requires no painting. Write for Bulletin #14.

THE ARABOL MANUFACTURING CO.
110 East 42nd St., New York 17, N. Y.
1835 S. 54th Ave., Chicago 50, Ill.
1950 16th St., San Francisco 3, Cal.

Adhesives?... ARABOL!

Canadian Degree-Days for January, 1950*

City	January		Cumulative Sept. 1 to Jan. 31	
	1950	Normal	1949-50	Normal
Calgary, Alta.	2434	1609	6146	5311
Charlottetown, P. E. I.	1389	1463	4077	4328
Crescent Valley, B. C.	1853	1352	5015	4631
Edmonton, Alta.	2573	1814	6572	5798
Fort William, Ont.	2077	1807	5871	5622
Grande Prairie, Alta.	2706	1841	6818	6000
Halifax, N. S.	1166	1283	3399	3898
London, Ont.	1094	1336	3748	4013
Medicine Hat, Alta.	2561	1643	5951	5032
Moncton, N. B.	1383	1528	4282	4714
Montreal, P. Q.	1348	1552	4237	4648
North Bay, Ont.	1550	1658	5097	5161
Ottawa, Ont.	1401	1646	4521	4923
Penticton, B. C.	1820	1184	4541	3810
Porquis Junction, Ont.	2021	2052	6149	5321
Prince George, B. C.	2623	1615	6422	5372
Quebec City, P. Q.	1516	1696	4633	5207
Regina, Sask.	2653	2037	6811	6373
St. John, N. B.	1277	1417	3907	4386
Saskatoon, Sask.	2821	2027	7086	6276
Toronto, Ont.	1037	1304	3417	3948
Vancouver, B. C.	1377	893	3538	3061
Victoria, B. C.	1206	815	3165	2725
Windsor, Ont.	1035	1283	3294	3729
Winnipeg, Man.	2511	2111	6528	5316

*These data are supplied through the courtesy of the Meteorological Division, Air Service Branch, Department of Transport, Canada.
The Department reports a slight revision in the figure for December for Quebec City, as reported in last month's issue. Corrected figure is 1330.

COMING EVENTS

Where listed, names or titles of individuals are those from whom further information is available.

WARM AIR CONFERENCE—19th annual Forced Warm Air Conference, sponsored by Michigan State College in cooperation with National Warm Air Heating and Air Conditioning Association, at Michigan State College, East Lansing 14, Mich. ..... **MARCH 20-23, 1950.**

REFRIGERATION MEETING — 1950 annual meeting of the Refrigeration Equipment Manufacturers Association, at Edgewater Beach Hotel, Chicago, Ill. Show Director, REMA, 1107 Clark Bldg., Pittsburgh 22, Pa. ..... **MARCH 30-APRIL 1, 1950.**

CORROSION CONFERENCE AND SHOW—1950 annual conference and exhibition of the National Association of Corrosion Engineers, at Jefferson Hotel, St. Louis, Mo. Secretary of Association, 919 Milam Bldg., Houston 2, Texas. ..... **APRIL 5-7, 1950.**

POWER CONFERENCE—12th annual Midwest Power Conference, sponsored by Illinois Institute of Techology, at Hotel Sherman, Chicago. Conference director, Roland A. Budenholzer, at Illinois Tech, 3300 S. Federal St., Chicago 16, Ill. ..... **APRIL 5-7, 1950.**

ASME MEETING—Spring meeting of the American Society of Mechanical Engineers, at Hotel Statler, Washington, D. C. C. E. Davies, secretary, 29 W. 39th St., New York 18, N. Y. ..... **APRIL 12-14, 1950.**

HYGIENE CONFERENCE—Joint conference of four groups, including American Industrial Hygiene Association, at the Hotel Sherman, Chicago, Ill. Dr. Henry Smythe, Jr., Industrial Hygience Foundation, 4400 Fifth Ave., Pittsburgh 13, Pa. ..... **APRIL 22-29, 1950.**

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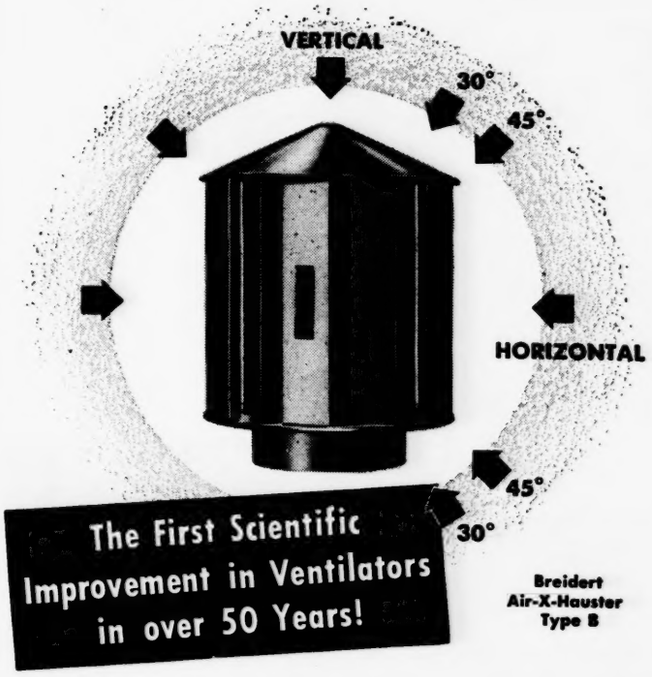

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